THE IRON TRADE REVIEW

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RAILROAD BUYING

ADDS AN ENCOURAGING FEATURE TO THE MARKET.

Western Lines Especially Prominent—Pig Iron Rather Dull in the Central West—The Available Supply.

Railroad buying, so long deferred and so much hoped for, has been resumed at an encouraging rate, and developments in the trade are almost entirely favorable. The Steel Corporation is now operating 74 per cent of its capacity, and has ordered the resumption of the Riverside plant of the National Tube Co., at Benwood, W. Va., after an idleness of 20 months. Some large independent companies have even a greater capacity in operation.

Iron Ore Sales

The sale of iron ore progresses at a steady rate, and one large interest with headquarters at Pittsburg, having disposed of 500,000 tons at regular prices, has withdrawn from the market. The strike on the lakes is annoying, but over 200 vessels are in commission, that number being more than enough to meet the requirements of the ore trade.

Railroad Activity

The heaviest buying by the railroads is in the Chicago district, where orders include 24,000 tons of shapes and plates for the Simplex Railway Appliance Co.; 100,000 tons of rails, contracts for a large number of new cars and for the repair of several thousand old ones; orders for 100 locomotives for the Union Pacific and 150 for the Harriman lines. The east has not, however, been unrepresented by new contracts. The Eastern Steel Co. will furnish 9,000 tons of shapes and the Central Iron & Steel Co. 7,000 tons of plates for track elevation of the Philadelphia & Reading, at Philadelphia; the New York Ship Building Co. has orders for two car floats requiring 750 tons of plates; the McClintic-Marshall Construction Co. has taken contracts for 5,500 tons of structural material for the Boston & Albany, and 2,300 tons for the Sunnyside viaduct of the Pennsylvania Tunnel & Terminal Co.

Pig Iron Conditions

In the east, the pig iron market in foundry grades is fairly active at somewhat higher prices, and about 20,000 tons of basic have been purchased. In other parts of the country the market is rather quiet. Southern prices for prompt shipment are on the basis of $11 for No. 2 Birmingham. Careful investigation of stocks of pig iron on furnace yards in all districts, including warrant iron, gives the tonnage as 1,300,000, which is not a large amount for fairly prosperous times.

Bars, Plates and Sheets

Recent buying of steel bars has brought heavy specifications to the mills, and some interests not anxious to sell have advanced quotations to 1.25c Pittsburg, but 1.20c is still the rate at which the selling is being done. Bar iron is dull, the mills having difficulty in getting enough orders to keep in operation. There is some weakness in sheets. New York City has advertised for 16,500 tons of cast iron pipe. The Ohio Fuel Supply Co. has contracted for 85 miles of 18-inch pipe for a gas line to be built from West Virginia gas fields to Cincinnati. The demand for old material is improving and prices are advancing. The recent advance in prices of wire products has been followed by the placing of a vast number of orders. A Connellsville coke interest has closed a long-term contract for about 400,000 tons annually, to be taken by an independent steel concern.

STEEL FOR TRACK ELEVATION.

(Special Telegram.)

Pittsburg, May 26.—It is understood that the steel for the track elevation work of the Philadelphia & Reading railway at Philadelphia will be furnished by independent interests in that district, the structural shapes, 9,000 tons, by the Eastern Steel Co., with works at Pottsville, and the plates, 7,000 tons, by the Central Iron & Steel Co., Harrisburg. The McClintic-Marshall Construction Co. has the general contract for steel work.

The Machinery club of the city of New York has elected the following as members of the board of governors: F. H. Stillman, E. D. Meier, Chas. A. Schieren Jr., Robert C. McKinney and L. P. Feustman, all to serve four years; and W. L. Candee and E. H. Benners to serve three years.

MACHINE TOOL BUILDERS MEETING.

(Special Telegram.)

Milwaukee, Wis., May 25.—The meeting of the National Tool Builders' Association at Milwaukee was called to order in the Plankinton House at 10 o'clock Tuesday morning by President Eberhard. The attendance of the first day included a representation from only about half of the association and was disappointing through the absence of eastern tool builders. At the morning session, committees were appointed and the scheduled papers read. The afternoon was given up to committee meetings.

ORDERS FOR RAILS AND CARS.

(Special Telegram.)

New York, N. Y., May 26.—The Illinois Steel Co. reports Bessemer rail sales as follows: Lake Shore, 15,400 tons; D., M. & N., 1,250; Katella company, 1,000 additional; Copper Range, 1,000; William Keneflick Co., 10,500; Dwyer Construction Co., 850; and St. Paul, 51,500.

Harriman interests are inquiring for 75,000 tons, part of which will go to the Colorado Fuel & Iron Co.

The Chesapeake & Ohio has ordered 1,000 more steel cars, and other inquiries are near closing.

THE WEEK IN IRON CENTERS

PITTSBURG.

Optimistic Feeling Prevails—Some Interests Advance Prices.

Office of THE IRON TRADE REVIEW,
510 Park Bldg., May 25.

More optimism is being shown in the iron and steel industry than for several years, as the current tonnage of orders to the mills is being maintained. By individual action, several companies have signalized their satisfaction with the business booked by raising their prices above those of their competitors, thereby practically withdrawing from the market. It is believed, however, among prominent interests that conditions, even if sustained, will justify only conservative price advances until the summer season shall have been passed and the industry shall have gained a strong impetus for the future.

The activity among buyers during the past four weeks has been very encouraging. Some of the steel companies were not especially prepared for a marked revival and were obliged to exercise rapid policies in adjusting production to the current demand. In one instance, a round tonnage of prompt pig iron was purchased from merchant companies.

The semi-finished steel market shows evidence of steady and widespread consumption. Steel makers with finishing capacities have been utilizing more and more of their Bessemer and open-hearth output for their own operations. Some of them accordingly are finding difficulty in filling the specifications from patrons on term contracts, so that they are avoiding making any promises of immediate shipment on new business.

Operations of important steel interests whose products are of a diversified nature continue favorably to reflect the heavy run of current orders. This week the Carnegie Steel Co. has active 73 per cent of its blast furnace, steel works and finishing mill equipment. Of the blast furnaces, 43 out of 59 stacks are blowing. The bar mills are running at 90 per cent of capacity and the plate and shape mills at 80 per cent. The activities of the Jones & Laughlin Steel Co. and the Republic Iron & Steel Co. are no less extensive. Both companies have their blast furnace and steel works capacities on in full. The former company will have some of its new blast furnaces now building at Aliquippa, Pa., in shape for firing about the end of the present year, as work upon their construction is now being pushed.

Iron Ore.—A prominent ore selling interest in this district, having disposed of about 500,000 tons for the season's delivery, at full prices, has withdrawn from the market and is notifying inquiring furnaces that it has taken on all the tonnage it desires.

Pig Iron.—Stronger sentiment is ruling in the pig iron market and prices are advancing. The low quotations which have been conspicuous factors of the quiet market of the past several months have been eliminated along with the appearance of a sharp increase in offered tonnage. Considerable iron in this movement, however, has been taken at the low mark and trading at the current higher prices is not heavy. The present inquiry is fair.

Recent transactions in Bessemer iron include 10,000 tons for prompt shipment to a steel company and two lots of 5,000 tons and 1,500 tons, respectively, for last half to ingot mold makers. The market at present is held from $15 to $15.25, although recent sales on prompt material have been at lower levels. Considerable interest is being shown in basic and this grade had advanced to $14.50, some makers asking $14.75 valley. A current report that a large steel interest had just taken 50,000 tons of this grade for extended shipment is denied in authoritative sources.

Foundry iron is selling in small lots at from $14.50 to $14.75 valley, and in some cases $15 valley is reported. Malleable ranges from $14.50 to $14,75 valley and gray forge from $13.50 to $13.75 valley. The Westinghouse Air Brake Co. this week bought 500 tons of malleable at about $14.50 valley and 500 tons of forge at about $13.50 valley, third quarter shipment being specified.

At the present time there are nine merchant furnaces in blast out of a total of 18 in the Mahoning and Shenango valleys. These are three Shenango, one Hubbard, Stewart, Brier Hill, Cherry Valley, Tod and Dover. Those idle are Mary, Ella, Claire, Fannie, Sharpsville, one Hubbard, Struthers and McKeefry.

On prompt and third quarter shipment on northern iron, we quote as follows:

Bessemer, valley	$15.00 to 15.25
Bessemer, Pittsburg	15.90 to 16.15
No. 2 foundry, Pittsburg	15.40 to 15.65
Gray forge, Pittsburg	14.65 to 14.90
Basic, valley	14.50 to 14.75
Basic, Pittsburg	15.40 to 15.65

Ferro-Alloys. — The ferro-manganese market has taken on renewed life and considerable negotiation for extended shipment is being carried on by consumers. Buying is heavier. A Youngstown steel interest in the week closed for about 2,000 tons for last half at about $41 seaboard at the present duty, and another steel company took 250 tons for the same delivery. Fifty per cent ferro-silicon continues to advance and prompt material is scarce. We quote 80 per cent ferro-manganese at $41 to $42 seaboard, with a freight rate of $1.95 to Pittsburg.

Fifty per cent ferro-silicon is quoted at $63 to $65 Pittsburg on forward deliveries; domestic, 12 per cent, $26; 11 per cent, $25; 10 per cent, $24, Pittsburg.

Plates. — Steel car inquiries are more numerous and the outlook for this industry shows some improvement. The Pennsylvania lines west have closed for 47 all-steel coaches, of which 18 postal cars were awarded to the Pressed Steel Car Co., six passenger and six passenger baggage cars to the Standard Steel Car Co. and 17 postal storage cars to the American Car & Foundry Co. The Pennsylvania lines east have taken figures on an assortment of 75 all-steel passenger coaches. The Standard Steel Car Co. will furnish 16 all-steel passenger coaches to the New York Central and 100 steel gondolas to the Maine Central. The Missouri Pacific railroad is in the market for a large block of steel freight cars and a number of steel passenger coaches. Locomotive companies have recently placed some large contracts for plates, but boiler and tank steel is not especially active. The plate mills in this district are working about 80 per cent of capacity. While there is shading of plate prices, the situation in this respect shows some improvement. We quote the present market as follows:

Tank plate, ¼-inch thick, 6¼ to 100 inches, 1.25c to 1.30c mill. Extras are as follows per 100 pounds: Boiler and flange steel plate, 0.10c; A. B. M. A. and ordinary firebox steel plates, 0.20c; still bottom steel, 0.30c; marine steel, 0.40c; locomotive firebox steel, 0.50c; all sketches, excepting straight taper plates varying not more than 4 inches in width at ends, narrowest end not being less than 30 inches, 0.10c; circles, 0.20c. Plates in widths over 100 inches up to 110 inches, 0.05c; over 110 inches up to 115 inches, 0.10c; over 115 inches up to 120 inches, 0.15c; over 120 inches up to 125 inches, 0.25c; over 125 inches up to 130 inches, 0.50c; over 130 inches, 1c. Gages under ½-

inch to and including 3/16-inch plate on thin edges, 0.10c; under 3/16 to and including No. 9, 0.25c. Five cents extra for less than carloads. Terms, net cash in 30 days.

Sheets—An important independent interest during the week advanced its prices in all grades of sheets $1 a ton over the independent schedule, or $2 above the minimum prices quoted. The volume of current business is being well sustained, so that makers are less inclined to make attractive propositions on deliveries or in prices. There is, however, some shading still being done and in iron sheets this is more marked. Operations are showing little change. We quote present minimum prices, which are subject to some shading, as follows:

Blue annealed sheets, Nos. 10 and heavier, 1.60c; Nos. 11 and 12, 1.65c; Nos. 13 and 14, 1.70c; Nos. 15 and 16, 1.80c; box annealed sheets, Nos. 10 to 12, 1.85c; Nos. 13 and 14, 1.90c; Nos. 15 and 16, 1.95c; Nos. 17 to 21, 2c; Nos. 22 to 24, 2.05c; Nos. 25 and 26, 2.10c; No. 27, 2.15c; No. 28, 2.20c; No. 29, 2.25c; No. 30, 2.35c; galvanized sheets, Nos. 13 and 14, 2.30c; Nos. 15 and 16, 2.40c; Nos. 17 to 21, 2.50c; Nos. 22 to 24, 2.65c; Nos. 25 and 26, 2.85c; No. 27, 3.05c; No. 28, 3.25c; No. 29, 3.35c; No. 30, 3.60c; painted roofing sheets, $1.55 per square for No. 28 gage, 2½-inch corrugation, and galvanized roofing sheets, $2.80 per square for No. 28 gage, 2½-inch corrugation.

Tin Plate.—Contracting by the fruit and vegetable canning interests is well out of the way and heavy shipments are going forward to this trade. Any increased demand from this source is now a matter of the extent of the crops. Orders for terne plate are numerous and the movement in this product at present is the most active in several years. Tin mill activities are about on the same basis. Tin plate prices are regular and we quote the present market as follows:

Coke tin plate, 100-pound basis, 14 x 20, $3.45 f. o. b. mill Pittsburg district and $3.40 in large lots. Terms, 30 days, less 2 per cent for cash in 10 days.

Rails and Track Material.—The Santa Fe system has just closed for 47,000 tons of standard rails which will be rolled by the Illinois Steel Co. The eastern lines are showing no greater interest in the market and the chances of their buying soon are not favorable. The standard rail mills at the Edgar Thomson plant are running at about the same gait at which they have operated for the past year. The light rail demand is very good and excellent records in tonnage booked have been made by the leading makers during the past month. The recently advanced prices are well maintained as the rerolling interests are not making very vigorous competition. Considerable spike business has been closed lately, but the market is not so active at present. On present specifications on Bessemer rails we quote as follows, the base price for open-hearth rails being $30 mill:

Fifty-pound and heavier, 500-ton lots and over, $28; carloads and less than 500 tons, $30; less than carload lots, $32; light rails in lots up to 250 tons, 8-pound, $29; 12-pound, $28; 16 to 25-pound, $27; 30 to 35-pound, $26.75; 40 to 45-pound, $26; on lots over 250 tons, prices are 60c less and over 500 tons, $1 less; angle splice bars for standard sections, 1.50c. Pittsburg standard spikes, 1.60c to 1.70c Pittsburg; hand spikes, 1.60c to 1.70c Pittsburg.

Steel.—The increased finishing operations of steel makers have resulted in a restricted tonnage of steel being available for the market, and sheet bars and open-hearth billets are not readily obtainable. The general demands of steel consumers have increased in a marked degree and some mills are finding difficulty in making deliveries within specified time, upon their contracts. The result of the improved conditions in steel is a strengthening of prices, and concessions on prompt material are disappearing.

Bessemer and open-hearth 4 x 4 billets with 0.25 carbon and less are quoted at $23 Pittsburg, with the usual extras for size and analysis, and forging billets at $25 Pittsburg. Sheet and tin bars are $25 Pittsburg. Steel makers divide the freight within the $1 limit, making the price in the immediate Pittsburg territory $23.50 delivered on billets and $25.50 delivered on sheet bars.

Hoops and Bands.—The large cooperage trade is not buying hoops with accustomed activity, but there is a fair demand from miscellaneous consumers. Not a great deal of contracting is being done. Prices in hoops have been more or less irregular. We quote the present market as follows:

Hoops in carload lots, 1.40c to 1.50c; in less than carload lots, 1.50c to 1.60c; bands, 1.20c, base half extras as per standard steel.

Merchant Bars.—Some of the leading makers of steel bars have found their order books in such a favorable state that they have adopted the policy of practically withdrawing from the market by quoting advanced prices. These companies are asking 1.25c Pittsburg while others of the important producers are still holding to the 1.20c base on business to be shipped up to Jan. 1. Beyond that time, higher prices are asked. Heavy specifications for soft steel continue to come to producers, and important merchant mills in this district, including those of the Republic Iron & Steel Co. and the Jones & Laughlin Steel Co. are running full. The mills of the Duquesne plant of the Carnegie Steel Co. are on in full and about 90 per cent of the total steel bar capacity of this interest is active, some of the isolated plants still being idle. Bar iron is showing some improvement and prices are stronger. The 1.30c Pittsburg base price is said to be the minimum for prompt shipment and $1 advance is being asked for third quarter. Makers are not aggressive for business on account of the advancing scrap market. Regular shafting discounts are being shaded. We quote current prices as follows:

Common iron bars, 1.30c to 1.35c Pittsburg; Bessemer and open-hearth steel bars, 1.20c to 1.25c; plow and cultivator, 1.20c to 1.25c; channels, angles, zees, tees, under 3-inch, 1.30c, all f. o. b. mill. The following differentials are maintained on steel: Less than 2,000 pounds, 0.10c advance; less than 1,000 pounds of a size, 0.30c advance. Cold rolled and ground shafting, 60 per cent in carloads, and 55 per cent in less than carloads, delivered in base territory. Planished and machine straightened tire is 1.40c base; iron finished tire under 1½ by 1½ inches, 1.35c, both plus ½ extra on tire card; iron finished tire, 1½ by ½ and over, 1.20c, plus ½ extra on the steel bar card.

On cold rolled strip steel, width 1½ inches and wider, and 0.100 inch and thicker, we quote base prices for 100 pounds, $3.05 on hard, and $3.30 on soft.

Structural Material.—A very fair run of structural inquiries continues to come to fabricators from the commercial trade while the railroads, particularly the western lines, are also doing a moderate contracting. Under the influence of the better conditions, fabricating prices are showing a slight improvement, although this is not yet general. The shape mills are running very full and are receiving liberal specifications. They are avoiding as much as possible extended requirement contracts. The 1.30c price appears firmer, although on attractive orders 1.25c may still be done. The West Penn hospital contract in this city has been placed with the Thompson-Starrett Co., and

the steel, about 1,200 tons, will be furnished by the McClintic-Marshall Construction Co. The American Bridge Co. will supply 800 tons for a new store building for B. White & Co. in this city. Bids will be taken May 29 on a public bridge for Venango county, which will take from 400 to 500 tons. A new building for nurses at the Allegheny general hospital will require 250 tons, and a Masonic temple at Butler, Pa., about 200 tons. The commissioners of Lawrence county have decided to build a concrete, instead of a steel, public bridge at New Castle, Pa. We quote the present market on structural shapes as follows:

Beams and channels, 15-inch and under, 1.25c to 1.30c; over 15 inches, 1.35c to 1.40c; zees, 1.25c to 1.30c; tees, 1.30c to 1.35c; angles, from 3 to 6 inches, 1.25c to 1.30c; over 6 inches, 1.35c to 1.40c; universal and sheared plates, 6¼ inches wide and wider, 1.25c to 1.30c.

Merchant Pipe.—The Ohio Fuel Supply Co. has placed a contract for 85 miles of 18-inch line pipe for a gas line from the Sugar Grove, W. Va., fields to Cincinnati and other Ohio points. A local interest has also taken five miles of 10-inch gas line pipe for West Virginia delivery. Among the new inquiries that have appeared are eight miles of 4¼ and 5-inch casing and 2 and 3-inch line pipe for Canada, 25 miles of 2-inch for Kansas and about 17 miles of 2 to 4-inch line pipe and 6¼ to 8¼-inch casing for the Kansas field. The market in tubular goods is in a very active state and buying is strong. The jobbers are showing a more liberal disposition to contract ahead, but the mills do not care to accept business for extended shipment at present prices. Merchant pipe prices are firm and in line pipe they are more regular than they have been. We quote the following official discounts on merchant pipe subject to an additional one point and five off to jobbers:

	—Steel—		—Iron—	
	Black.	Galv.	Black.	Galv.
⅛ and ¼ inch.....	72	56	69	..
⅜ inch	73	59	70	56
½ inch	76	64	73	61
¾ to 6 inch.....	80	70	77	67
7 to 12 inch.....	75	60	72	57
PLUGGED AND REAMED.				
1 to 4 inch.....	78	68	75	65
EXTRA STRONG PLAIN ENDS.				
⅛ to ⅜ inch.....	65	53	62	50
½ to 4 inch.....	72	60	59	57
4½ to 8 inch.....	68	56	65	53
DOUBLE EXTRA STRONG PLAIN ENDS.				
¼ to 8 inch.....	61	50	58	47

Boiler Tubes.—Electrical and water power construction are evidently having a deterrent effect upon the demand for boiler tubes. The merchant trade is not especially active and the railroads are not ordering very liberally. Some shading is being done in tubes. We quote the following official discounts on lap-welded steel boiler tubes to jobbers in carloads:

1 to 1½ inch.....	50
1¾ to 2¼ inch.....	62
2½ inch	64
2¾ to 5 inch.....	70
6 to 13 inch	62

2½ inch and smaller, over 18 feet, 10 per cent net extra.
2¾ inch and larger, over 22 feet, 10 per cent net extra.
To destinations east of the Mississippi river will be sold at delivered discount for carloads lowered by two points, for lengths 22 feet and under; longer lenghts, f. o. b. Pittsburg.

We quote the following official discounts on charcoal iron tubes to jobbers:

1 to 1½ inch.....	45
1¾ to 2¼ inch.....	45
2½ inch	50
2¾ to 5 inch.....	45
6 to 13 inch.....	45

Wire Products.—The recent advance in the price of wire products has brought out a heavy rush of orders and the mills have entered large tonnages upon their books. Jobbers and consumers have been desirous of contracting for extended period at today's level, but makers will not accept present prices on shipments beyond Aug. 1. Some companies are asking advances of from $2 to $4 a ton on long-time contracts. The probability of a further advance in wire products in the near future is being discussed. We quote the present market in wire products as follows:

Wire nails, jobbers' carload lots, $1.70; retailers' carload lots, $1.75; painted barb wire, jobbers' carload lots, $1.70; retailers' carload lots, $1.75, with 30c for galvanizing; plain wire to jobbers in carloads, $1.50, and to retailers in carloads, $1.55; polished staples, $1.70; galvanized staples, $2.

Wire Rods.—While low prices on rods have recently prevailed, some change for the better in this respect is noted. We quote the revised market at $28 to $29 Pittsburg on Bessemer and $29 to $30 Pittsburg on open-hearth rods, but these figures have recently been shaded.

Coke.—Slight evidence of improvement in coke is to be noted, as some of the extremely low prices on spot furnace grades are no longer available, and $1.50 ovens is the present minimum. A sale of 12,000 tons of furnace coke, 2,000 tons monthly for last half, was made this week at $1.70 ovens. Considerable buying of foundry coke has been done during the past week and 10 days, and one interest reports transactions aggregating 40,000 tons for six to 12 months' deliveries at $2 to $2.25 ovens. Some operators are getting to the point with their orders that they are seriously considering withdrawing from the market until prices improve. Bargain terms in foundry coke are still being offered in some sources and a sanitary manufacturing interest was enabled to close under $2 ovens the past week for its yearly requirements from July 1. We quote spot furnace coke at from $1.50 to $1.60 ovens and on contract from $1.60 to $1.70 ovens, according to grade. On first class Connellsville foundry coke the range is from $1.80 to $2 ovens for prompt shipment and on contract from $1.90 to $2.25 ovens. The *Courier's* figures for the week ending May 15 show 22,650 ovens active with an output of 252,485 tons, compared with 22,216 active ovens and a production of 244,279 tons the previous week.

Old Material.—The dealers are practically dominating the scrap situation as they are bidding up offerings and are holding the material for advanced prices. A comparative scarcity of scrap resulting from less activity on the part of the railroads and industrial companies in the recent past is aiding the attitude of the dealers in giving the market an upward impetus. During the past week, prices generally advanced 50 cents a ton. The mills continue to buy sparingly because of the higher level and are coming into the market only as their needs are forcing them. We quote gross tons delivered in the Pittsburg district as follows:

Heavy melting scrap, $15.75 to $16.25; re-rolling rails, $15.75 to $16.25; bundled sheet scrap, $12.75 to $13.25; iron axles, $20 to $21; old iron rails, $18 to $18.50; No. 1 wrought scrap, $15 to $15.50; old car wheels, $16 to $16.50; low phosphorus, $18.50 to $19; machine shop turnings, $10.50 to $11; cast borings, $9.25 to $9.75; No. 1 cast scrap, $15 to $15.25; malleable, $14 to $15; stove plate, $11.50 to $12.

CHICAGO.

Buying of Railroads the Prominent Feature—Pig Iron Dull.

Office of THE IRON TRADE REVIEW,
1328 Monadnock Block, May 25.

The placing of large tonnages of heavy steel products, particularly shapes and plates, continues. Notable among recent orders was one for 24,000 tons of shapes and plates, the contract being accompanied by specifications covering the entire tonnages. This steel is to be used for railroad equipment. Orders for an aggregate of 100,00 tons of rails were placed, including 51,000 tons for the St. Paul, 26,000 for the Santa Fe, 15,000 tons for the Chicago & Northwestern and 5,000 tons for the Northern Pacific. Contracts

covering a large number of new cars and the repairing of several thousand old cars are reported and generally the past fortnight has been one of improved buying activity on the part of the railroads. The attitude of the mills, particularly with regard to steel bars, is much more conservative and in some instances, orders are declined where prompt shipment is asked. This is especially true of the eastern independent mills. These interests are holding prices firmly at 1.20c for steel bars and 1.30c for shapes and plates, f. o. b. Pittsburg. The western mill situation seems less rigid and business for which prompt specifications can be given can be readily placed, sometimes at better than the above prices. Bar iron and hard steel are a little stronger. The demand for billets is not large and the price is about as it was, perhaps a little stronger. Sheet prices continue unsettled. In contrast to the decided increase of tonnage in steel products, the inquiry for pig iron is very light and sales are made in small quantities only. Inquiries for several thousand tons are reported. The price is without change. The scrap market is stiffer and prices have advanced from 25 to 50 cents above those of last week.

Pig Iron.—A few inquiries of fair tonnage including one for 1,000 tons, one for 1,500 tons and another for several thousand tons are reported in this market, but generally the inquiry is very light and prices are weak. It is claimed that on local iron $16 delivered at Chicago can be done and the situation is such that this price seems not unlikely. Little new business is going to the south and a limited amount of tonnage for prompt shipment can undoubtedly be obtained as low as $11 still. For the last half $11.50 remains the asking price. There is reason to believe that all of the iron bought in the last movement is not being taken promptly and reports indicate that stocks at southern furnaces are slightly increased if anything. We quote for delivery at Chicago as follows:

Lake Superior charcoal	$19.50 to 20.00
Northern foundry No. 1	16.65 to 17.15
Northern foundry No. 2	16.15 to 16.65
Northern foundry No. 3	15.65 to 16.15
Southern foundry No. 1	16.35 to 16.85
Southern foundry No. 2	15.85 to 16.35
Southern foundry No. 3	15.35 to 15.85
Southern foundry No. 4	14.85 to 15.35
Southern No. 1 soft	16.35 to 16.85
Southern No. 2 soft	15.85 to 16.35
Southern gray forge	13.85 to 14.35
Southern mottled	13.60 to 14.10
Southern silveries, 4 per cent silicon	17.60 to 18.10
Southern silveries, 5 per cent silicon	18.10 to 18.60
Southern silveries, 6 per cent silicon	18.60 to 19.10
Jackson Co. silveries, 6 per cent	19.90
Jackson Co. silveries, 8 per cent	20.90
Jackson Co. silveries, 10 per cent	21.90
Malleable Bessemer	16.40 to 16.85
Standard Bessemer	17.00 to 17.50
Alabama basic	16.35 to 16.85

Billets.—The few sales of forging billets reported in this market last week, although bringing out some variation in prices, also showed a tendency toward a firmer attitude on the part of several mills who would prefer now to save their steel for finished product. A sale of 500 tons to a South Milwaukee interest brought $25.90 delivered, several orders were placed at $26 and one was reported as high as $27 Chicago. We continue to quote on the basis of $21 Pittsburg for rolling billets, as follows: For 4 x 4 rolling billets, $24, and for forging billets, $26, Chicago base.

Merchant Bars.—The leading interest reports that steel bar specifications are in greater volume than at any previous time. Some eastern mills are turning down bar business because they cannot promise satisfactory delivery and all evidence points to a large tonnage on the books of all the mills for which shipping specifications have already been received. Bar iron has received a sympathetic impetus, but no great interest is manifested in this product. Prices are fairly firm on the basis of 1.20c Pittsburg for steel bars, although this price has been shaded in some instances below 1.33c Chicago. Bar iron is selling from 1.25c to 1.30c. Hard steel angles and bars are bringing better prices and 1.25c is being quoted. We quote as follows:

Bar iron, 1.25c; soft steel bars and bands, 1.35c to 1.38c; half extras; soft steel angles, less than 3 x 3, 1.48c; hoops, 1.78c base, full extras, planished or smooth finished tire steel, 1.58c; iron finish, up to 1½ x ½-inch, 1.53c base tire card; iron finish, 1½ x ½-inch and larger, 1.38c base steel card; channel for solid rubber tire, ¾ to 1 inch, 1.88c, and 1⅛-inch and larger, 1.78c; smooth-finished machinery steel, 1.63c; flat sleigh shoe, 1.43c; concave and convex sleigh shoe, 1.63c; cutter shoe, 2.75c; toe calk steel, 1.93c; railway spring, 1.73c, base steel card; vehicle spring steel, 1.78c, base vehicle card; crucible tool steel, 7c to 9c, with higher prices asked on special grades. Quotations on shafting are 60 per cent off the list for carload lots, and 55 per cent off for less than carload lots, carload freight allowed to points in base territory. On iron and steel bars from local stocks, we quote as follows: Bar iron, 1.70c to 1.80c full extras; soft steel bars, 1.50c per 100 pounds base, plus half extras; soft steel hoops, 2.10c, full extras.

Plates.—For car building and bridge work, large tonnages of plates have been ordered from the mills and from the standpoint of tonnage most of the mills have in specifications all of the material that they can deliver promptly. In the order placed by the Simplex Railway Appliance Co. several days ago, was one specification for 2,200 tons of 12 x 1 inch universal plate. Specifications from the other western car builders are also being received, calling for large tonnages. The price of 1.30c Pittsburg is being generally observed in the west although quotations materially below 1.48c Chicago have been brought out on shipments from western mills by special conditions.

For mill prices see Pittsburg report. Freight to Chicago, 18 cents. We quote for shipment from local stocks as follows:

Tank steel, ¼-inch and heavier, up to 72 inches wide, 1.60c to 1.70c; from 72 inches wide to 96 inches wide, 1.70c to 1.80c; 3/16-inch up to and including 60 inches wide, 1.70c to 1.75c; 72 inches wide, 1.95c to 2c; No. 8 up to 60 inches wide, 1.70c to 1.75c. Flange and head quality, 25c extra.

Sheets.—The weakness in the prices of sheets, particularly galvanized, on which concessions of as much as $2 a ton are made, continues. Black sheets are firmer and are bringing more regular prices. It is understood that the Atlanta mill has contracted for its sheet bar requirements for the year and will resume operations next week after having been shut down since the general reductions were made in sheet prices. For mill prices, see Pittsburg report. Freight to Chicago, 18 cents. We quote store prices at Chicago as follows:

No. 10, 2c to 2.10c; No. 12, 2.05 to 2.15c; No. 14, 2.10c to 2.20c; No. 16, 2.20c to 2.30c; Nos. 18-20, 2.50c to 2.55c; Nos. 22-24, 2.55c to 2.60c; No. 26, 2.60c to 2.65c; No. 27, 2.65c to 2.70c; No. 28, 2.75c to 2.80c; No. 30, 3.05c; galvanized sheets, Nos. 10 to 16, 3c to 3.10c; Nos. 18 to 20, 3.05c to 3.15c; Nos. 22 to 24, 3.20c to 3.25c; No. 26, 3.40c to 3.45c; No. 27, 3.60c to 3.65c; No. 28, 3.80c to 3.90c; No. 30, 4.20c to 4.50c.

Structural Steel.—The tonnage of fabricated material which has been ordered and for which prices are now being asked in this market is very large and has developed to its present proportions in surprisingly quick time. The Simplex Railway Appliance Co. placed the contract with the leading interest for 24,000 tons of shapes and plates, specifications for shipment accompanying the order. Among the items in this tonnage in addition to

the plate item mentioned above was one for 4,400 tons of beams of one weight and length. Geo. W. Jackson, Inc., is in the market for a large tonnage reported to be from 20,000 to 25,000 tons. On the heavier shapes, prices are firm, but on lighter structurals some difficulty is experienced in bringing about a relinquishment of the low prices recently prevailing. During the week, over 50,000 tons of fabricated steel was placed under contract, of which nearly nine-tenths was taken by independent interests. In the west the contracts were not very numerous. A bottling plant at Denver for Adolph Coors requiring 300 tons of steel will be erected by the Minneapolis Steel & Machinery Co. Bids have been taken on from 800 to 1,000 tons for a Calumet river bridge for the Western Indiana R. R. and for 1,500 tons for the Brandeis theater and office building at Omaha. Bids are to be received May 31 for 1,000 tons for additions to the Pontchartrain hotel at Detroit. The American Dredge Co. is to build at Fort Wayne a shop requiring 500 tons. Among the prospects for the near future are a railroad bridge of 12,000 tons and a highway bridge of 2,200 tons both at Portland and a bridge at Kansas City which will call for 13,500 tons. For mill prices see Pittsburg report. Freight to Chicago 18 cents. We quote from local jobbers' stocks as follows:

All angles, 3 inches and larger, including 6 inches, $1.60 per 100 pounds; angles over 6 inches, $1.70 per 100 pounds base; beams, 3 to 15 inches, inclusive, $1.60 per 100 pounds base; channels, 3 inches and larger, $1.60 per 100 pounds base.

Rails and Track Supplies.—Railroad buying has noticeably increased in all lines of railroad requirements. Contracts for car repairing include one order for the repair of 8,000 cars awarded to the American Car & Equipment Co. by the Illinois Central R. R. The Pullman Co. recently took an order for 1,500 cars for the Harriman lines. Specifications for track fastenings are improving also. Among the rail orders placed during the week were 5,000 tons for the Northern Pacific, open-hearth rails; 10,000 tons for the Chicago & Northwestern R. R., and an aggregate of 5,000 tons in small orders. There is in addition a large tonnage in prospect. The demand for light rails is improving and orders are now being obtained at the higher prices. Inquiries from traction lines and small steam railroads are good and increasing. For standard sections, see Pittsburg report. We quote as follows: Light rails, 40 and 45-pound, $26; 30 and 35-pound, $26.75; 16, 20 and 25-pound, $27; 12-pound, $28. In lots of 250 to 500 tons a reduction of 60 cents a ton from these prices is made; lots of 500 tons and up carry a reduction of $1 a ton. Track supplies, f. o. b. Joliet, angle bars, 1.50c to 1.60c; spikes, 1.75c; track bolts, with square nuts, 2.15c to 2.20c; with hexagon nuts, 2.30c to 2.40c; small railroad and square boat spikes, 1.90c base, f. o. b. Chicago.

Merchant Pipe and Boiler Tubes.—While there is not the large increase in tonnage in merchant pipe and tubes that characterizes the other lines of finished steel products, a gradual improvement is noted. Prices are not disturbed. We quote for lap-weld tubes out of store, 65 off, and for charcoal, 50 off. For mill discounts, see Pittsburg report.

Cast Iron Pipe.—Little of interest transpired during the week and no lettings of importance were scheduled. The letting of 400 tons at East Grand Forks, Minn., was postponed and bids will again be asked on June 6. Prices are unchanged and we quote as follows:

Four-inch water pipe, $27.50; 6 to 14-inch, $26.50; larger sizes, $25.50; gas pipe, $1 a ton higher.

Wire Products.—The tardiness of the season has given opportunity for the continuance of buying of wire for fencing and the tonnage of barb wire is unusually good. Wire nails also are in good demand and some orders for car builders have taken several thousand kegs. The leading interest is not contracting freely and is seeking to restrict buying to the requirements of the next 60 days. We quote:

Wire nails, jobbers' carload lots, $1.88; retailers' carload lots, $1.93; retailers, less than carload lots, $2.03; painted barb wire, jobbers' carload lots, $1.88; retailers' carload lots, $1.93, with 30c for galvanizing; plain wire to jobbers in carloads, $1.68; staples, $1.88. Wire rods, Bessemer, $27; open-hearth, $28; chain rods, $27, f. o. b. Pittsburg.

Old Material.—The local scrap market is stronger this week than last and higher prices are prevailing. The Illinois Central list, which was the principal offering last week, brought prices fully 25 cents above the level of the preceding week. Practically all of the local consumers are willing to take on tonnage at the market level and while the price of scrap seems to be somewhat high as compared with the level of finished material prices, the market appears to be well supported. We have revised our prices and quote gross tons in the first paragraph as follows:

Old car wheels	$15.00 to 15.50
Old iron rails	17.25 to 17.75
Rerolling rails (4 ft. and over)	15.00 to 15.50
Old steel rails (4 ft. and under)	14.50 to 15.00
Light section relayers, 45 lbs. and under subject to inspection	21.00 to 23.00
Relaying rails, subject to inspection	19.00 to 19.50
Frogs, switches and guards	13.75 to 14.25
Heavy melting steel	14.00 to 14.50

We quote, net tons, as follows:

No. 1 R. R. wrought	$13.25 to 13.75
No. 2 R. R. wrought	12.25 to 12.75
Knucklers, couplers and springs	13.00 to 13.50
Shafting	15.75 to 16.25
Iron car axles	18.25 to 18.75
Steel car axles	17.00 to 17.50
Dealers' forge No. 1	10.00 to 11.00
Pipes and flues	10.00 to 10.50
No. 1 cast, 150 lbs. and less	13.75 to 14.25
No. 1 mill	7.25 to 7.75
Mixed busheling (Nos. 1 and 2)	8.50 to 9.00
Country sheet	5.00 to 5.50
No. 1 boiler cut	9.25 to 9.75
Boiler punchings	12.00 to 12.50
Cast borings	5.75 to 6.25
Mixed borings, etc	5.75 to 6.25
Machine shop turnings	7.00 to 7.50
Railroad malleable	12.75 to 13.25
Agricultural malleable	11.25 to 11.75
Stove plate and light cast scrap	12.00 to 12.50
Old iron splice bars	15.75 to 16.25

CLEVELAND.

Ore Market in Good Condition—Lull in Finished Materials.

Office of THE IRON TRADE REVIEW,
Browning Building, May 25.

Iron Ore.—Buying of iron ore has continued at a very satisfactory rate, and the outlook is regarded as favorable. The strike on the lakes is causing much annoyance, and there is danger of the longshoremen joining the strikers, but the ore movement up to date is fully equal to the demands of the trade.

On base ores with the guarantee of 55 per cent on old range and Mesabi Bessemer, and 51½ per cent on old range and Mesabi non-Bessemer, we quote as follows: Old range Bessemer, $4.50; Mesabi Bessemer, $4.25; old range non-Bessemer, $3.70; Mesabi non-Bessemer, $3.50.

Pig Iron.—The pig iron market is quiet, but prices are firm, and there is a tendency toward higher quotations. No transactions of importance are reported. We quote delivered in Cleveland as follows:

No. 1 foundry	$15.70 to 15.75
No. 2 foundry	15.20 to 15.25
No. 3 foundry	14.70 to 14.75
No. 2 southern	15.35 to 15.85
Gray forge	14.00 to 14.50
Bessemer	15.65 to 15.90
Lake Superior charcoal	19.00 to 19.50
Jackson Co. 8 per cent silvery	20.05

Coke.—The Struthers plant at Fairbank, Pa., 200 ovens, has resumed and expects to continue operations throughout the summer. There is very little activity in the coke market, and prices are unchanged. We quote spot furnace coke at $1.45 to $1.65 at the ovens, and on contract,

$1.70 to $1.75; for first class Connellsville foundry coke, we quote spot at $1.80 to $2, and on contract, $2 to $2.25.

Finished Materials.—There is a little lull in the market, due to the fact that mills are well supplied with orders, and buyers are covered for their requirements as fully as they care to do for the present. On steel bars some mills are now unable to make delivery in less than five weeks, and are not anxious to book more business. The usual quotation is 1.20c, but some interests have advanced to 1.25c. In structural material, the only important contract reported is for the Brown building, on Euclid avenue, awarded to the Interstate Engineering Co. It is understood that the bid of this company was very low. The order for the steel, about 1,200 tons, has not yet been placed. Present plans call for a five-story building, but provide for very substantial construction and 10 stories may be added later. The contract for the Anisfield building has not yet been awarded. Bar iron is dull, and Cleveland mills have difficulty in securing enough orders to continue in operation.

Old Material.—Another marking up of prices took place this week, the increase varying from $1 to $1.50 a ton. Some material is passing to consumers but not in notable quantities, local buyers coming into the market slowly. The railroads continue to get better prices for their material, a notable instance being the list of the Nickel Plate which closed last Friday. We quote f. o. b. Cleveland, as follows:

Old iron rails	$16.00 to 16.50
Old steel rails (re-rolling)	15.00 to 15.50
Old steel rails (under 6 feet)	15.00 to 15.50
Old car wheels	15.00 to 15.50
Old steel boiler plate	12.00 to 12.50
Mallable iron (railroad)	14.00 to 14.50
Steel axles	17.50 to 18.00
Malleable iron (Agricultural)	13.00 to 13.50
Heavy steel	14.25 to 14.75
Country mixed steel	13.00 to 13.50
Low phosphorus	16.00 to 16.50

We quote, net tons, as follows:

No. 1 R. R. wrought	$13.50 to 14.00
No. 1 busheling	12.00 to 12.50
No. 1 machine cast	12.50 to 13.00
Iron axles	17.00 to 17.50
Axle turnings	9.50 to 10.00
Machine shop turnings	8.00 to 8.50
Grate bars	11.00 to 11.50
Pipes and flues	11.50 to 12.00
Tank iron	10.00 to 10.50
Hoop and band iron	9.00 to 9.50
Sheet iron	8.00 to 8.50
Wrought drillings	8.00 to 8.50
Stove plate	11.00 to 11.50
Cast borings	7.00 to 7.50

The Texas legislature has passed a bill loaning $100,000 to the penitentiary board for 18 months for the purpose of placing the blast furnace and attached pipe foundry at Rusk penitentiary in operation, probably not soon, however.

CINCINNATI.

Pig Iron Rather Quiet with Prices Well Maintained.

Office of THE IRON TRADE REVIEW,
First National Bank Bldg., May 25.

Pig Iron.—The market is moderately quiet with prices fairly well maintained. But few transactions of importance have been reported during the week. A sale of 1,100 tons of gray forge for third quarter delivery at $10.25 Birmingham to an Indiana melter may be accepted as locating the minimum price on this grade. Another sale of 400 tons is also reported on the same basis. A large manufacturer of plumbing supplies bought about 1,500 tons of southern foundry iron and is in the market for 4,000 to 5,000 tons for its Louisville plant. One sale of 600 tons of southern iron is reported on a basis of $12 Birmingham for deliveries extending over the remainder of the year. Two central Ohio engine builders are in the market for 1,000 tons each. There is an inquiry from an Illinois concern calling for 1,000 to 1,500 tons of various grades. Some smaller lots of southern charcoal have been sold at $19.50 Birmingham. A firm offer of $14 Ironton for 3,500 tons of northern foundry has been made, but so far as can be learned has been turned down. Some scattering lots of southern foundry have sold at $11.50 Birmingham for No. 2 for third quarter. There is very little doing in northern iron since the advance to $14.50 Ironton, which practically represents the market now for spot iron as well as for forward delivery. Prompt shipment southern iron is obtainable at $11 Birmingham, although a number of the producers are holding at $11.50. Some southern irons are obtainable at $11.50 Birmingham for the last half of the year, but fourth quarter alone, for which there are a few inquiries, is held mainly at $12 Birmingham. Low grades are scarce and while $10.25 has been done on gray forge, the general quotation is about $10.50, so that southern prices for No. 3, No. 4 and gray forge are practically quotable at the same figure, namely $10.50 Birmingham. There is very little call for high silicons. Some scattering basic inquiry from other markets is under consideration here. We quote for prompt delivery and May and June, delivered Cincinnati, based on freight rates of $3.25 from Birmingham and $1.20 from Ironton, as follows:

Southern foundry No. 1	$14.75 to 15.25
Southern foundry No. 2	14.25 to 14.75
Southern foundry No. 3	13.75 to 14.25
Southern foundry No. 4	13.75
Southern No. 1 soft	14.75 to 15.25
Southern No. 2 soft	14.25 to 14.75
Southern gray forge	13.50 to 13.75
Northern No. 1 foundry	16.20
Northern No. 2 foundry	15.70
Northern No. 3 foundry	15.20
Jackson county 6 per cent silicon	18.70
Jackson county 8 per cent silicon	19.70
Jackson county 10 per cent silicon	20.70

Finished Material.—The market continues firm in tone with a fairly good demand and specifications on contracts are footing up a satisfactory tonnage. One of the large interests in steel bars has advanced its price to 1.25c Pittsburg.

Coke.—The market continues moderately active and, while not quotably changed, is somewhat firmer. One contract with the leading pipe interest for delivery at its Louisville and Columbus plants, involving about 15 cars per week for one year, was closed during the week. A number of foundries are covering their wants for the last half of the year and some for the 12 months beginning July 1. There is apparently a better call for foundry coke on contracts, and shipments are slightly increased. The following quotations represent the spread between spot and contract coke, although spot coke is firmer and some of the ovens have withdrawn inside prices.

	Per Ton.
Wise county furnace coke	$1.60 to 1.85
Wise county foundry coke	2.00 to 2.25
Pocahontas furnace coke	1.65 to 1.85
Pocahontas foundry coke	1.85 to 2.25
Standard Connellsville furnace coke	1.60 to 2.00
Standard Connellsville foundry coke	1.90 to 2.40

Old Material.—The market is firm with dealers advancing prices and sales have been made at higher levels than last week. A southern Ohio mill is obtaining prices on both heavy melting steel and basic for last quarter delivery. Dealers' prices here are as follows:

Old No. 1 R. R. wrought net tons	$13.50 to 14.00
No. 1 machinery, net tons	13.00 to 13.50
Old iron rails, gross tons	15.50 to 16.50
Old steel rails (re-rolling) gross tons	14.50 to 15.00
Old short lengths, gross tons	14.00 to 14.50
Old iron axles, net tons	17.00 to 17.50
Heavy melting scrap, gross tons	13.25 to 14.00
Stove plate, net tons	11.00 to 11.50
Heavy turnings, net	9.00 to 9.50
Cast borings, net tons	6.50 to 7.50
Car wheels	14.50 to 15.00

PHILADELPHIA.

Pig Iron Prices Advancing—More Sales of Basic.

May 25.

Pig Iron.—A general advance of from 25 to 50 cents has been made in this district without checking the volume of current business to any appreciable extent. As was the case the previous week, probably the heaviest tonnage placed during the week under review was of basic iron, on which the new level is $15.50 delivered. One

large independent steel interest, which had taken on a good tonnage during the rush of $15 buying, came into the market again and purchased 20,000 tons for third quarter delivery, paying approximately $15.50, and some other smaller purchases are reported, making it certain that the aggregate tonnage placed during the week was considerable. In foundry irons the present level is $15.75 furnace for prompt or third quarter iron, and $16 for fourth quarter, but these figures are being shaded to some extent. Active buying is reported by practically all classes of consumers, and it is noteworthy that the smaller melters are entering the market in larger numbers. One sale of low phosphorus iron is noted, a lot of 3,000 tons by an eastern Pennsylvania producer, but the price is not reported. Pipe makers are picking up bargain lots wherever they can be obtained, but the supply is very limited and difficulty is encountered in securing any important tonnages. Forge iron is in considerable demand and is quoted at $15.25, delivered, but is so scarce that basic iron is being offered as a substitute for puddling purposes. Southern furnaces seem to be holding firmly at $11.50 as minimum. Recent sales of Virginia product on a basis of $13, furnace, are noted, but the majority of producers are asking considerably more. The monthly meeting of the Eastern Pig Iron Association showed a heavy increase in orders on hand and a slight decrease in stocks, indicating that the pig iron industry in this district is in an extremely strong statistical position. We quote, delivered at eastern Pennsylvania plants through the third quarter, as follows:

No. 1X foundry	$16.75 to 17.25
No. 2X foundry	16.25 to 16.75
No. 2 plain	15.75 to 16.25
Standard gray forge	15.25 to 15.75
Basic	15.50
Low phosphorus	19.00 to 20.00
No. 2 Birmingham	15.75 to 16.25
No. 2X Virginia	16.50 to 17.00
No. 2 plain Virginia	16.25 to 16.50

Finished Materials.—The market is without feature so far as structural lettings of importance are concerned. Several propositions already noted are still under consideration, but no further awards have been made and practically no new business is developing. About 250 tons of steel will be required for improvements on the U. G. I. building at Eleventh and Market; Bethlehem shapes are specified. A brisk trade is being done in plain materials of every class. Prices are now well established on the new level and there is talk of further advances. Bar iron continues inactive, but with this exception the situation is firm. We quote: Structural shapes, 1.45c to 1.50c; plates, 1.45c to 1.50c; sheets, No. 28, 2.80c; steel bars, 1.35c to 1.40c; refined bar iron, 1.35c to 1.45c.

Old Materials.—Reports have been current that a very large tonnage of heavy melting steel has been acquired by one of the larger eastern Pennsylvania mills. This interest, however, states that it has merely picked up the small lots offered from time to time and that the total tonnage involved is not important. The demand for this line of scrap is good and a ready sale is found for all that can be had, but holders are still looking for higher prices. Low phosphorus scrap has advanced and we note one sale of 1,000 tons. Trading has been fairly brisk in a number of other lines and prices have increased quite generally. We quote, delivered at eastern Pennsylvania plants, as follows:

Old steel rails (rerolling)	$15.50 to 16.00
No. 1 steel scrap	15.25 to 15.75
Old steel axles	19.50 to 20.00
Old iron axles	21.50 to 22.00
Old iron rails	18.00 to 18.50
Old car wheels	15.25 to 15.75
Choice scrap R. R. No. 1 wrought	17.50 to 18.00
No. 1 yard scrap	15.50 to 16.00
Machinery scrap	14.50 to 15.00
Low phosphorus scrap	19.50 to 20.00
Wrought iron pipe	15.00 to 15.50
No. 1 forge fire scrap	13.00 to 13.50
No. 2 forge fire scrap, ordinary	8.50 to 9.00
Wrought turnings	12.50 to 13.00
Axle turnings, heavy	13.00 to 13.50
Cast borings	10.00 to 10.50
Stove plates	13.00 to 13.50

NEW YORK.

Good Demand for Foundry Grades of Pig Iron at Higher Quotations.

Office of THE IRON TRADE REVIEW,
Room 1005, No. 90 West St., May 25.

Pig Iron.—With the exception that most of the larger buyers have already covered their probable requirements as far ahead as is possible at the current level of prices, the market is maintaining activities at about the same rate as prevailed earlier in the month. Additional furnace interests have come up to the higher level to such an extent as to render the advance general, and the business now going on is at the new figures, which average about 50 cents over those of a fortnight ago. Buying is now confined chiefly to foundry irons and is practically all in lots ranging from 1,000 tons downward, for delivery during the third quarter. There is no basic buying of importance in this immediate section, though the movement in eastern Pennsylvania has continued and some inquiry is current in New England. Malleable is very quiet. The tone of the market continues healthy, and a number of interests which are considered shrewd buyers are taking on bargain lots of iron whenever obtainable, stocking it against future requirements rather than pay the premium demanded on advance deliveries. We quote, New York tidewater delivery during June and the third quarter, as follows:

Northern foundry No. 1	$16.75 to 17.00
No. 2X foundry	16.25 to 16.75
No. 2 plain	15.75 to 16.25
No. 2 southern foundry	15.75 to 16.25
Malleable	16.25 to 16.75
Gray forge	15.25 to 15.75

Ferro-Alloys.—A Youngstown consumer has purchased several lots of ferro-manganese, understood to aggregate about 2,000 tons, for last half shipment at a price about $40.50, seaboard. On other scattered selling through the west, somewhat higher prices prevailed, the average being about $41. In the eastern district, two sales totaling 1,300 tons have been made and inquiries now current, chiefly in that section, amount to at least 2,500 tons. Probably 200 tons of ferro-silicon have been sold during the past week, the price on prompt material being $61 to $62, Pittsburg, and on futures $64 to $65.

Finished Materials.—Structural lettings of the week have been fairly numerous, but in no case have involved important tonnages. Two or three large projects will probably be closed in the early future, however, and the total business of the month bids fair to equal that of April. Bids go in Friday on the Vanderbilt Hotel, 5,000 tons, and the day previous on the substructure of the post office at the new Pennsylvania station, 9,000 tons. These projects, with the Winner bridge at Kansas City, 13,000 tons, are the largest lettings in immediate prospect. The Eastern Steel Co. will supply 500 tons of steel for a cotton mill at Salem, Mass.; the receivers of Milliken Bros., by special permission of the court, have taken about 2,000 tons of transmission towers for Great Falls, Mont., and two small buildings on the Pacific coast; the A. E. Norton Co. has a 300-ton building in this city; and southern interests have booked several small structural jobs in the Norfolk district.

Railroad work has not been heavy, though several locomotive orders are noted, among them that of the Union Pacific for 100 locomotives from the American Locomotive Co. and of the Harriman system for 150. The New York Ship Building Co. has orders for two car floats requiring 750 tons of plates. The Pennsylvania Steel Co. reports several small sales of girder rails aggregating 500 tons.

Operations continue to improve, both with the leading interest and the independent eastern mills. The Cor-

poration has given orders to start the Riverside plant of the National Tube Co., at Benwood, W. Va., after an idleness of about 20 months. Without counting this plant as active, the Corporation is now operating 74 per cent of normal. Prices on fabricated material are beginning to show the effect of recent heavy bookings. A few interests are still making low prices, but others are asking considerable advances and the situation is consequently ragged. We quote:

Angles, 3 to 6 inches x ¼-inch and heavier, 1.46c; beams, 3 to 15 inches, 1.46c; tees, 3 x ¼-inch and heavier, 1.51c; plates, carloads, tank, 1.46c; marine boiler, 1.86c; bar iron, 1.35c to 1.40c; soft steel bars, 1.36c; sheets, No. 28 black, 2.56c.

Cast Iron Pipe.—New York City advertises a contractors' letting July 9 on about 16,500 tons of double weight pipe, mostly large sizes, for the continuation of the high pressure system. The United States Cast Iron Pipe & Foundry Co. has secured an order for 900 tons from the Brooklyn Union. Otherwise the market is without feature and prices remain low.

Old Materials.—Aside from the fact that there is a brisk current demand for the more active lines of scrap, particularly heavy melting steel, the market is featureless. There have been reports of heavy purchases by steel mills south of here, but these prove to have had no more substantiation than that chance offerings at bargain prices were taken up, no large tonnages being involved. About 900 tons of miscellaneous scrap from the San Francisco ruins, brought around by ship, is being offered at Philadelphia. A Steel Corporation subsidiary has purchased 3,000 tons of detinned scrap in this district. We quote, gross tons, New York tidewater, as follows:

Old steel rails (rerolling)	$13.50 to 14.50
Relaying rails	19.00 to 19.50
Old car wheels	13.00 to 13.50
Old iron car axles	17.00 to 17.50
Old steel car axles	15.50 to 16.00
Heavy melting steel	12.00 to 12.50
No. 1 railroad wrought	15.00 to 15.50
Iron track scrap	12.50 to 13.00
Wrought pipe	11.00 to 11.50
Cast borings	7.00 to 7.50
Wrought turnings	8.00 to 8.50
Heavy cast scrap	12.50 to 13.00
Railroad malleable	11.50 to 12.00
Stove plate	10.00 to 10.50
Grate bars	10.00 to 10.50

BUFFALO.

Finishing Mills Well Supplied with Orders.

Office of THE IRON TRADE REVIEW,
932 Ellicott Square, May 25.

Pig Iron.—The same general quotations prevail this week with continued improvement of tone in the market. An advance in prices would not surprise many at this point if it were to come at an early date. The call for tonnage ranges between 100 and 1,000-ton lots. No very large consumers are reported in the local market now. We quote, f. o. b. Buffalo, as follows:

No. 1X foundry	$15.00 to 15.50
No. 2X foundry	14.50 to 15.00
No. 2 plain	14.25 to 14.75
No. 3X foundry	14.00 to 14.50
Malleable Bessemer	16.50 to 17.00
Gray forge	14.00 to 14.50
Charcoal	19.25 to 20.25

Finished Products.—The finished material lines have stiffened up considerably, so much so, in fact, that the mills find it impossible to keep up with orders and in most cases are from three to five weeks behind with orders, due to the rush with which consumers have come into the market for material. Everything possible, it is said, is being done to eliminate the delay, but the extent of new business has caused almost a blockade, according to local reports. Certain interests declined quotations on bars and small shapes, so much business being booked that delivery on new orders could not be made for several months, if taken. The past month mills kept up on deliveries within two weeks. Consumers who hesitated about placing orders when the market was more unsteady than it is today have placed business, paying an advance of $1 in some instances on bars and small shapes.

Bids on structural material for the proposed Men's Hotel, 700 tons, Buffalo, go in tomorrow. H. C. Hanower & Co. were lowest bidders on Hamlin building, 450 tons. Aside from these transactions this end of the market was not active the week closed.

ST. LOUIS.

Pig Iron Selling Not Heavy—Some Inquiry for Coke.

May 24.

Pig Iron.—The pig iron market in the St. Louis territory took advantage of the attendance of dealers at the convention in Cincinnati and went on a strike. Prices remained firm, but the buying was by no means active, and inquiries were fewer than was expected. Dealers in the St. Louis territory admit that one or two furnaces are offering southern iron at $11 Birmingham, but as a rule they refuse to quote lower prices than $15.25 to $15.75, delivered, for the third quarter. When pressed, however, some of them admit $15.25 is nearer correct. The sales last week were light, but there is an inquiry out now for 750 tons for all grades for delivery from July to October. The inquiry comes from a large stove manufactory in Quincy, Ill., and probably will be closed within a a few days. Northern iron is quoted at $14, Ironton, for immediate delivery, and at $14.50 for shipment over the remainder of the year. One inquiry for 1,200 tons of malleable is out, and an Illinois car company is in the market for 500 tons of northern iron and 300 tons of malleable Bessemer. The demand from foundrymen is fairly good. Stove foundry orders are running light, and orders from jobbing foundries are improving. Our quotations, delivered, to which the freight of $3.75 from Birmingham has been added, follow:

No. 1 southern	$15.75 to 16.25
No. 2 southern	15.25 to 15.75
No. 3 southern	14.75 to 15.25
No. 4 southern	14.25 to 14.75

Coke.—An inquiry for 25,000 tons of foundry coke is in the market, and probably will be let tomorrow. The inquirer is one of the largest car manufacturing establishments in the St. Louis territory, and delivery will be made over the remainder of the year. Connellsville 72-hour best selected foundry coke is held at $2 to $2.25, ovens, for shipment up to Jan. 1, while some high-sulphur coke is selling at lower prices. The quotation on 48-hour Connellsville furnace coke, ovens, is $1.60 to $1.70 a ton for all deliveries. Quotations on Virginia and West Virginia grades remain unchanged. The freight to East St. Louis and St. Louis is $2.80 a ton, and $2.70 from the Virginia fields when shipment is consigned beyond St. Louis.

Old Material.—The market is dull, with quotations ruling as follows:

Cast iron borings, free from foreign material, net tons	$ 5.00 to 5.50
Steel axle turnings, gross tons	10.00 to 11.00
Steel railroad axles, net tons	16.50 to 17.00
Iron railroad axles, net tons	17.50 to 18.50
Miscellaneous steel scrap, gross tons	9.00 to 11.00
Old car wheels, gross tons	14.50
No. 1 railroad cast scrap, net tons	12.00 to 12.50
Heavy machinery cast, net tons	11.50 to 12.50
Stove plate and light cast, net tons	10.00 to 11.00
Sheet iron, net tons, uncut	4.00 to 5.00
No. 1 railroad wrought, net tons	12.00 to 13.00
Railroad malleable, net tons	12.00 to 12.50
Heavy melting steel, net tons	11.00 to 12.00
Relaying rails, net tons	16.00 to 17.50

BIRMINGHAM, ALA.

Pig Iron Dull and Prices are Not So Firm.

May 24.

Hope and confidence in the future are expressed by the pig iron manufacturers in the Birmingham district. The activity in the iron mar-

ket that was reported during April is not apparent now by any means and there is little accumulation. The quotations are not so firm as they have been either, some selling going on in this district at $11 per ton, No. 2 foundry, practically immediate delivery. Two or three of the companies in this district are holding their iron for $11.50 per ton, immediate delivery, $12 per ton for third quarter, and are not looking hard for business for last quarter delivery. There are some inquiries still being received here, but the buying movement is not starting in by any means. A curtailment of the production, and on a large scale, is one of the intentions of the very near future. This will come about principally because of necessity for repairs at furnaces. The Williamson furnace shuts down this week. The furnace of the Woodstock Iron Co., at Anniston, and the furnace of the Central Foundry Iron Co., at Holt, are both reported as needing repairing. Two or three other furnaces are said to be in need of relining and other work which will be attended to shortly. The Tennessee Coal, Iron & Railroad Co. has but four furnaces in blast in this district, all located at Bessemer. All the iron makers of this company at Ensley are cold. The Woodward Iron Co. has but two furnaces in blast at Woodward. The make for the month should show a falling off as compared to the output in April, though an increase will be shown when compared to the output in May of last year. There is some iron to be seen on furnace yards in this district and there is still some accumulation going on, but the manufacturers are hopeful, as stated, and believe that there will be an improvement by the end of the summer, if not before.

The cast iron pipe and soil pipe industry is the one active business in this district in the iron line. The shipment of a solid train load of 31 cars of Universal pipe and joints from the plant of the Central Foundry Co., in Bessemer, Ala., last week, bound for Arizona, was an incident in the industrial section here that attracted attention. We quote as follows:

Old iron rails	$13.00 to 14.00
Old iron axles	13.00 to 14.00
Old steel axles	12.00 to 12.50
Old steel rails	9.00 to 9.50
No. 1 railroad wrought	12.50 to 13.00
No. 2 railroad wrought	10.50 to 11.00
No. 1 country	8.00 to 8.50
Heavy melting steel	8.50 to 9.00
Old steel boiler plate	7.00 to 7.50
No. 1 machinery	10.00 to 11.00
Old standard car wheels	12.00 to 12.50
Stove plate	8.50 to 9.00
Cast iron borings	4.00 to 4.50

SEATTLE.

Southern Pig Iron Seems to be Having an Inning.

Office of THE IRON TRADE REVIEW, 302 Pioneer Bldg., May 21.

Pig Iron.—Sales of European iron are light, but there is considerable inquiry for domestic iron. Contracts have been made recently for several small lots of 500 tons each of southern No. 2 at a price said to be about $21.50 f. o. b. Seattle. The brokers do not feel that the present low price of American iron will result in any permanent increase in the consumption of the domestic product; on the other hand, the foundrymen are showing decided interest in American iron and are purchasing it much more freely than ever before. About 1,500 tons of Cleveland No. 1, English, will be in port by June 15, 1,000 tons of it on the ship Zinita. The Celticburn with another lot of about 900 tons is due the latter part of June. The Norwegian ship Skjold with 1,000 tons of English iron due in Seattle in July, has been disabled and forced to put into port at St. Vincent, Cape Verde Islands. Her cargo will be transferred and will arrive in Seattle sometime in December. We quote in gross tons as follows:

English, Cleveland No. 1, spot.	$25.00 to 25.50
English soft No. 1 to arrive June	23.50 to 24.00
English soft No. 1 to arrive Sept., Oct., Dec.	22.00 to 22.50
Southern soft, No. 2 (domestic)	22.00 to 22.50
English Hematite, No. 1 strong, soft, limited quantity	25.50 to 26.00

Merchant Iron.—The market is exhibiting no unusual features. The volume of buying is fair and rather encouraging. Prices are being well maintained, although the jobbers feel that consumption would be increased if the prices of common iron bars were reduced slightly. There have been considerable shipments of local bars to Hawaii in the past few weeks. We quote base prices per 100 pounds, f. o. b. Seattle: Common iron bars, $2.25; soft steel bars, $2.35; machinery steel, $2.75; Norway iron, $3.50; angles, channels, zees and tees, under 3 inches, $2.75.

Sheets.—The demand for sheets locally is unusually brisk and but very few shipments being received are going into stock. The consumption in the local market for May will be close to 300 tons. Prices are higher than the corresponding Pittsburg price plus the freight, except for single orders of one or more carloads. We quote as follows: Blue annealed sheets, No. 12, 2.95c; No. 14, 3c; No. 16, 3.10c; Nos. 22 to 24, 3.55c; No. 28, 3.70c. Galvanized sheets, Nos. 10, 12 and 14, 3.60c; No. 16, 3.70c; Nos. 22 to 24, 4.10c; No. 28, 4.70c.

Old Material.—The foundries are buying quite freely and May sales will amount to about 2,000 tons for the Seattle district alone. Prices are stiffening and some dealers are asking as high as $20 a net ton for No. 1 cast scrap. Car wheels have also advanced slightly. On account of comparative inactivity in lumber circles, the volume of scrap available is less than is usual at this time of the year. We quote in net tons f. o. b. Seattle:

Foundry and machinery scrap	$18.50 to 20.00
Old car wheels	16.50 to 17.50
Railroad wrought	10.00 to 11.00
Country wrought and busheling	5.00 to 8.00

BRITISH IRON MARKETS.

Improvement Has Not Kept Up and Prices Suffer Reduction.

Office of THE IRON TRADE REVIEW, Prince's Chambers, Corporation St., Birmingham, Eng., May 15.

Conditions in the iron trade this week are comparatively unchanged. The slight improvement reported a week ago is scarcely maintained. Yesterday's quotation for No. 3 Cleveland iron at Middlesbrough was 48s ($11.76), which represents a reduction on the week of 3d per ton. Despite anticipations of a week ago that the stocks at Connal's this week would show a reduction, there has been an increase of the tonnage in store, the present amount being 212,843 tons. This shows an increase of 1,000 tons in a single day, and about 5,000 tons since Tuesday last. Generally speaking, the prospects for the near future are regarded as hopeful. The Midland market is not quite so strong in tone this week, though selling rates have so far been maintained. Pig iron makers have a fair amount of business on hand, and not being eager for new work are enabled to withstand the demands of makers for reduction of price.

In consequence of the increase of Middlesborough stocks the speculative market has weakened considerably. Business on the Birmingham Exchange on Thursday was dull and quiet, and the attendance somewhat small, but no alterations of price were recorded. The slackening of business in the pig iron department which is very marked is attributed to the unsatisfactory state of affairs in regard to finished iron. In finished lines the demand is far below the productive capacity of the district, and the outlook far from satisfactory. The lack of con-

fidence in market conditions is most clearly displayed by the refusal of consumers to place forward contracts, purchases at present being of a purely hand to mouth nature. Local conditions are very markedly affected by Middlesbrough, and the dullness here is thought to be due to the falling prices of the northern market. Conditions are far less satisfactory than could be desired and merchants and makers alike are beginning to chafe at the lagging of the long-desired recovery.

METAL MARKETS.

NEW YORK.

May 25.

Copper.—A continuance of the steady demand which has prevailed for some little time has held the market stationary on the same level as a week ago. There is no excitement in the market and no effort is being made to push sales, but melters seem to be gaining confidence in the outlook and are buying moderately all the while. We quote: Lake, 13⅛ to 13⅜; electrolytic, 12⅞c to 13c; casting, 12¾c to 12⅞c.

Pig Tin.—Consumption is running along at about the same rate and the domestic market shows little change, current sales being of satisfactory volume at a shade above 29c for prompt metal.

Pig Lead.—The stronger tone noted a week ago has continued to such an extent that prices have remained about stationary, though the tendency is clearly upward. Current selling is on the basis of 4.30 to 4.40c, New York.

Spelter.—Galvanizers are inquiring for considerable amounts and the price level has advanced in keeping with the demand. We quote: 5.15c to 5.20c, New York.

Antimony.—Cookson's 8¼c to 8½c; U. S. 7¾c to 8c; other brands 7½c to 7¾c.

CHICAGO.

May 25.

Business in metals has been fairly brisk during the past week, especially in copper. Copper prices are very firm and are generally higher than a week ago. Spelter is somewhat stronger and slight advances are recorded in the prices. We quote as follows:

Lake copper, carload lots, 13¾c to 14c; casting, carload lots, 13½c to 13¼c; pig tin, 31c to 31½c; spelter, 5.15c to 5.30c; pig lead, desilverized, 4.40c to 4.50c in 50-ton lots; corroding, 4.75c to 4.80c in 50-ton lots; car lots, 2½c per 100 pounds higher; sheet zinc, 6¾c list f. o. b. LaSalle in car lots of 600-pound flasks; Cookson's antimony, 10½c to 11c; other grades, 10c.

Prices on old metals are somewhat stronger and fractional advances have been made during the week. We quote:

Copper wire, 11¾c; heavy copper, 11½c; light copper, 10¾c; heavy red brass, 10¾c; heavy yellow brass, 8½c; light brass, 6¼c; No. 1 red brass borings, 8¾c; No. 1 yellow brass borings, 7¾c; brass clippings, 8¼c; tea lead, 3½c; lead scrap, 3.85c; zinc, 3.40c; tin pipe, 24½c; tin foil, 23c; pewter, 17½c; electrotype plates, free from wood, 3.80c; electrotype dross, 2.65c; stereotype plates, 4½c; stereotype dross, 3.75c; prime slab zinc dross, $54 per ton.

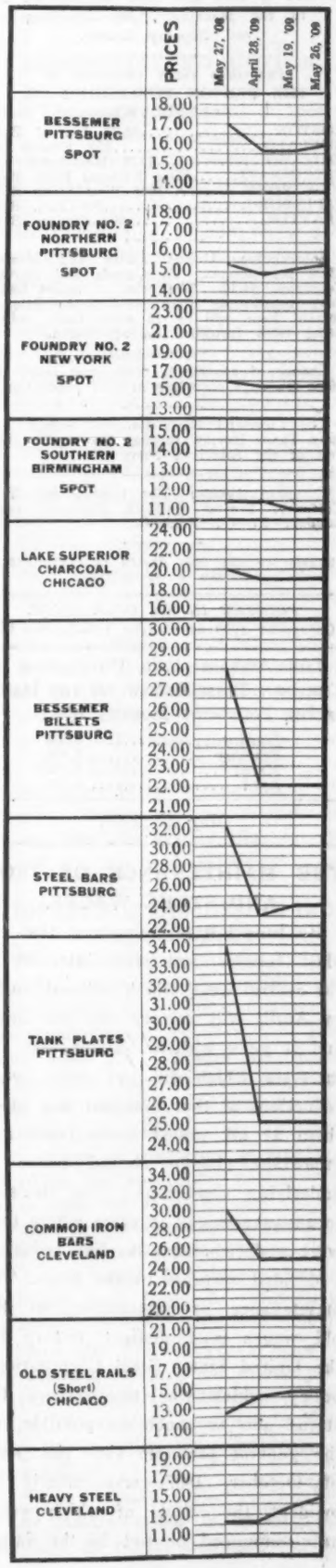
ST. LOUIS.

May 24.

Lead and Zinc.—The Joplin district exceeded its record for any previous week for more than a year with a total output last week of lead and zinc ores valued at $323,915. The production of blende and calamine was usually heavy. Toward the close of the week the price of blende rose to $41, and $42 is rumored to have been paid. The highest price reported for extra grade zinc ore was $43.50 a ton, on an assay base of $40.50 a ton. Early in the week the bidding was strong at $39, the figure at which the bulk of ore was sold during the previous week. The market became stronger by Wednesday, however, and a $40 base was recorded. It jumped to $41 on Friday. A majority of workmen returned at their former schedule of wages, and all probabilities of a strike were dispelled by the higher prices paid for ore.

Spelter quotations at St. Louis were $5.07½, and the market evinced a somewhat stronger tone than for the preceding week. The demand for zinc ore was so strong at the close of the week that it is believed the price will soar to $43 before the present week closes. A curtailment of output has resulted. The best price for 80 per cent lead ore was $58 a ton. Sales were unusually heavy and values were good. Some of the ore sold for $57. At the close of the week, pig lead was quoted at St. Louis at $4.30. Calamine was stronger at $19 base for 40 per cent ore. Extra choice lots brought $26.

PRICE CHART.



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February	5,346
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April	5,508

May 27, 1909.

THE MAINTENANCE OF IRON AND STEEL WAGES.

By June 1 it is understood that the blast furnace and steel interests in the central west, which reduced wages in April, will restore the old rates, and it goes without saying that the interests which did not make wage reductions at that time will not make them at all, unless some fresh and important change should occur in underlying conditions. The decision to advance wages, in cases where they were reduced recently, has come as a decided surprise to the trade. The maintenance or restoration, of the old wages is a distinct victory for the United States Steel Corporation's policy, which was to preserve the status quo as much as possible, on the general principle that the panic of October, 1907, was merely an incident, the effects of which would be pronounced or not in the future according to how sentiment was molded.

That the question of whether or not there would be a general reduction in wages in the iron and steel trade was undecided until recently must, however, be admitted. The scale was turned by the revival in buying which has proceeded apace since some time in March, and by the further assurance that there will be no radical reduction in the iron and steel tariff duties. The maintenance of wages is doubtless in large measure a corollary of the latter proposition.

The development in the general matter of wages will have an important bearing upon the Amalgamated association wage settlements which are to come up between now and July 1. The recent annual convention of the association in Detroit decided to adopt the existing scales for the tin mills, sheet mills and iron mills, for presentation to the manufacturers. Under less conservative management, the Amalgamated association might have put some demands for advances in the convention scales for trading purposes, but the association is not run on such principles, and has aimed, in the past few years at any rate, not to demand anything which it did not have some fair argument to back up. The general decision as to wage maintenance in the iron and steel industry in the central west precludes the possibility of any large reduction being made in the sheet and tin plate scales at this time, and it must be remembered that last year there were slight reductions in these scales, when there was no general reduction of wages in the industry. The tin plate scale was reduced by 6 per cent on all jobs except heating, which worked out an average reduction of 4.7 per cent on the entire scale. The sheet scale was changed from a part tonnage and part day rate to a uniform tonnage rate, the computations being made on the basis of reducing the rates, as thus brought to a uniform basis, by 1¾ per cent.

The iron mill scale presents a more complicated situation, as the conditions to be considered run back to the settlement of 1907. The award of the conciliation board in that year will long be remembered. It gave the men practically all they asked for, and gave the manufacturers practically nothing. It created no surprise in any quarter when manufacturers thereafter declined to continue the conciliation arrangement. As respects bar iron at 1.20c and over, and prices below that line need not be considered for the forthcoming scale year, the Cambridge Springs award gave the men a straight advance of 50 cents a ton on puddling, with a number of important advances in other parts of the scale. The settlement of 1908 took off this 50-cent advance in puddling, practically restoring the 1906-7 scale, while in other directions it made, on an average, reductions only slightly greater than the advances of 1907. Thus the existing iron mill scale is very close to the 1906-7 scale.

Conditions in the industry, however, have changed greatly. The present conditions should rightly be compared with those ruling during the scale year of 1906-7. In that twelvemonth the average selling price of Bessemer pig iron was exactly $21, valley, and the average of basic pig iron $20.66, an average for the two grades of $20.83. The present market stands at an average of $14.75, or $6 a ton less. The price of steel bars in that twelvemonth was $31.25 a net ton, against $24 at present, a decline of $7.25. These reductions hang well together. The change in heavy melting scrap, on the contrary, does not agree at all. The present market on heavy melting steel is not much more than $2 a ton, certainly not as much as $3 a ton, less than the average price during the twelvemonth being considered. These comparisons involve facts which the iron mill must consider. It must perforce consider the price at which steel bars are sold, because a portion of its product is sold in direct competition with steel bars, and another and still larger portion,

while not sold directly in competition with steel bars, is sold to buyers who consider the price of steel bars as an important governing factor. Again, the iron mill must consider the price of heavy melting steel, because the general scrap market is molded largely by that price. If the price of melting steel advances, the market for the grades of scrap used by the iron mill advances also, and if melting steel refuses to decline, iron mill scrap does not decline, or declines but little.

The iron mills are thus compelled to face the condition that it has become much more difficult to sell their finished product, while it is not much easier to buy their raw material. The men of course may argue that this is not their concern, that they are responsible for furnishing labor, not raw material. But manufacturers and men, however, in their mutual relations are responsible to each other for maintaining the industry. If wages are made too high, the manufacturers will be driven out of the business, and if wages are made too low, the men will be driven out of the business, but, if either is forced out, the other is forced out. If it comes about that the issue is to be drawn along these lines, the situation must perforce hinge upon the strength of the Amalgamated association as a labor organization. Years ago that was the clearly recognized point at issue in every scale settlement, but in late years it has not been. The scale settlements have not really been on the basis of strength, because more modern means have been found for developing a settlement, and those means are not likely to fail this year.

CHINA'S FOREIGN TRADE.

Editor THE IRON TRADE REVIEW:—

With considerable interest I read the dispatch from Washington under the heading "To Race Germany for Chinese Trade," in the issue of the *New York Herald* for April 27.

During the last few years much has been said and written about the necessity for the building up of a trade with China. It is remarkable to note, however, how little has been accomplished in this direction by the American manufacturer. In England and Germany the best brains of the country are employed in the development of the export trade, while in this country the greater portion of the manufacturers look upon this class of business as a "quantite negligeable." This should not be. If necessary, we must adopt foreign methods and systems to further our export trade.

An experience for a number of years, in one of the principal trade centers of the Far East, and a careful study of the situation both at home and abroad leave no doubt in my mind as to the ultimate success which awaits the American financier and manufacturer if they will conduct their campaign along common sense and reasonable lines. Americans must, however, take advantage of the present favorable conditions and by uniting in a strong and well conducted campaign and by assisting the Chinese in the development of their railways and other industrial enterprises they will secure a large share of China's foreign trade.

I. L. SUSTMAN-JACOB.

30 Church street, New York, April 29, 1909.

STUBBORN FIGHT

Against the Open Shop on the Lakes —A Chief Engineer Beaten.

Apathy continues to mark the lake trade, probably not more than one-third of the available fleet being in commission. Of the 530 freight carriers belonging to the Lake Carriers' Association, 220 have been placed in commission. Certain members of the association have decided not to operate any of their vessels this season. For instance, the Tonawanda Iron & Steel Co. has put its fleet of 14 vessels in ordinary at Gratwick, and will carry its ore in chartered ships during the remainder of the year. There is little demand for tonnage.

The Marine Engineers' Beneficial Association is making a determined fight against the open shop policy of the Lake Carriers' Association and is getting sympathetic support from the Seamen's union. Some violence has accompanied the strike, so that the ships are under armed guard while in port. The Marine Engineers' Beneficial Association resents this warlike spirit, though it seems to be necessary. Some of the engineers who have signed contracts for the season have met with intimidation. Douglas Brews, chief engineer of the Hanna fleet, was severely beaten under the Superior street viaduct on Monday night.

It is impossible to state how long the strike will last or what embarrassments it will lead to, but it is the opinion of the well-informed in the trade that if business should be offered freely, the strike would fall of its own weight. It is well known that independent owners have welcomed the delay caused by the strike, as it cannot fail to improve conditions during the latter part of the year to a sensible degree.

The coal rate has been established upon last year's basis, 30 cents to the head of the lakes, 35 cents to the lesser Lake Michigan ports and 40 cents to Milwaukee, but there is little business to be had.

INDUSTRIAL EDUCATION

Was Thoroughly Discussed at Indianapolis Meetings.

At a meeting of the members of the administrative council of the National Metal Trades Association held at Indianapolis, May 17 and 18, a general discussion took place on the question of further promotion of industrial education. It was agreed to furnish $2,000 annually for four years for the maintenance of the school for machinists at Winona Technical Institute at Indianapolis, and the Indianapolis branch agreed to furnish $1,000 additional for four years. With this fund of $12,000 it is believed that the department can be opened, the equipment having been supplied already, and 30 students enrolled. The administrative council of the National Founders' Association was in session at Indianapolis at the same time. After some discussion it was decided to postpone the meeting of the National Metal Trades and the National Founders' joint committee until a later date. Through funds furnished by the Founders' associations, 23 students are being maintained in the foundry department of Winona institute, and the results thus far obtained are declared satisfactory.

CONFERENCE DISCUSSING IRON WAGE SCALES.

The representatives of the Western Bar Iron Association went into conference with the scale committee of the Amalgamated Association of Iron, Steel and Tin Workers at Detroit, Wednesday, May 26, to arrange the iron mill wage scales for the year from July 1, 1909, to July 1, 1910.

No form of arbitration is now provided in the agreement between the mills and the men, because of the continuous working agreement having been abrogated. Efforts have been made to settle the wage question this year with dispatch. The Amalgamated association, however, has reaffirmed the present year's scale as representing its proposal to the manufacturers while the latter have asked for a 10 per cent reduction, so that some deliberation in conference is expected.

The American Car & Foundry Co. will hold its annual meeting June 24.

PIG IRON DUTY.

And Other Important Parts of Metal Schedule Still Being Considered.

Washington, D. C., May 24.—With the metal schedule practically completed as to most of its details, there still remian to be considered some of the basic items, including pig iron and scrap iron and some issues that have arisen regarding the relative rates on materials and finished products. The finance committee has won on every point throughout the schedule, and such concessions as have been made on different items were suggested in the interests of harmony, and with a view to placing the bill in such form before the conference committees of the two houses as to give the best possible assurances of a satisfactory bill when it shall emerge from those committees.

The principal feature of the metal schedule upon which the finance committee has been successful is in maintaining the higher duties provided for highly finished and semi-finished steel products, including particularly structural steel, ingots and billets. Notwithstanding the vigorous opposition that was made by some of the western Republican and Democratic senators against the advances in rates on "high speed steel," the increased rates on this modern steel were secured without serious opposition after the matter had been thoroughly threshed over in the debate. All the provisions carried into the bill by the finance committee for increasing the duties on high grade ingots and assembled and finished structural steel, as well as in cutlery, received the approval of the senate.

Ferro Alloys.

The items in the metal schedule still open for final adjustment cover such basic materials as will presumably not affect, if changed from the rates reported by the finance committee, the items covering finished iron and steel products. There is considerable contention over ferro alloys, and vigorous efforts are being made to reduce the excessive rate on electrolytic ferrosilicon, which is 25 per cent in the senate bill. The Dingley rate is $4. This question remains for further consideration by the finance committee in connection with the pig iron duties and the disposition which shall finally be made of the issues over scrap iron.

Among the changes made by the finance committee in the rates as reported in the senate bill, compared with the house bill or the existing law, is a reduction in the duty on wire for fencing. The present rate is 1½ cents a pound, which is reduced by the house to 1 cent a pound, and this rate was favorably reported by the finance committee. Upon the urgent request of western senators, the finance committee agreed to a reduction in this rate to ¾ of a cent a pound.

Relative Rates.

At this point arises important issues regarding the relative rates imposed by the bill as it stands respecting ingots and billets, and finished wire rods, cotton ties, wire nails, etc. In view of the changes made in the rates on ingots and billets, which result in some increase in the average ad valorem rates of duty covering these steel imports over the existing law, the idea of continuing the lower rates on hoop steel or cotton ties, wire and wire nails, is resented by those who are familiar with the conditions surrounding the industries engaged in manufacturing these products. A policy has sprung up in recent tariffs, beginning with the tariff law of 1890, of making some concessions on steel products of general consumption, such as wire, cotton ties and wire nails, with the result that the average ad valorem rates of duty on these finished products range in the tariff at from a half to one-third lower than the rates on ingots and billets, or wire rods from which these articles are manufactured.

Cotton Ties.

The rate on cotton ties has been reduced from six-tenths of a cent a pound to four-tenths of a cent, making a change in the average ad valorem rate from 15 per cent down to 10 per cent. While the average ad valorem rate on wire for fencing is not as low as the rate on cotton ties, the change from 1½ cents a pound down to ¾ of a cent a pound on fencing wire reduces the average ad valorem rate of duty down to 20 per cent. An illustration of the operation of these lower duties on finished products is also shown in the case of wire nails. The existing rate of the Dingley law is ½ a cent a pound on wire nails, which was reduced in the house bill to ¼ of a cent a pound, and this duty was approved by the finance committee. Strenuous objections have been registered by the wire nail manufacturers against this change, which they assert carries the average ad valorem rate of duty too far below the duties on ingots and wire rods. Under the present law, the average ad valorem rate of duty on wire nails is about 10 per cent. It is reduced below 5 per cent under the bill as reported by the finance committee. This is a lower ad valorem rate than is carried on wire fencing or steel cotton ties.

Zinc Products.

Apart from the iron and steel features of the metal schedule, another controverted question is over the zinc content of ore and zinc products. The senate committee has reported an amendment covering these items, and an effort will be made during the coming week to reach a final agreement upon zinc and zinc products, in line with the proposition for graduated duties from ¼ of a cent to 1 cent a pound on the zinc content of ores, and from 1 1/3 cents to 1¾ cents on smelter products. Efforts will also be made to adjust the duties on pig iron and scrap iron, and the controverted questions regarding the lower rates on cotton ties, wire and nails, compared with the rates on billets and rods.

ARTHUR J. DODGE.

ALGOMA STEEL CO. AWARDS CONTRACT FOR MILL.

(Special Telegram.)

Pittsburg, May 26.—The Algoma Steel Co., Sault Ste. Marie, Ont., has awarded Mackintosh, Hemphill & Co., this city, the entire contract for its new 18-inch and 12-inch combination structural and merchant mill. The equipment will consist of continuous heating furnaces with gas producers and coal and ash handling machinery, an 18-inch and a 12-inch three-high mill to be driven by electric motors, tables, cooling beds with transfer machinery, straightening machine, saws and shears. There will be two electric overhead traveling cranes in the main building and every provision made for the economical handling of the varied products which it will be necessary to manufacture in order to meet the demands of the Canadian market.

MORE BLAST FURNACES BLOWN IN.

Four additional blast furnaces were fired by the Carnegie Steel Co. during the past week and the company is now working 43 out of a total of 59 stacks. The last idle furnace at the Edgar Thomson group has been put in operation and for the first time in several years all of the 11 stacks of this plant are making iron. The steel from Edgar Thomson is being shipped to other finishing mills, as the rail mills are running light. The Bellaire steel works blooming and finishing mills resumed operations May 24, after a prolonged idleness.

ADDITIONAL STATISTICS

Of Production Finished by the American Iron and Steel Association.

The American Iron and Steel Association has published some additional statistics of production for 1908:

Hammered Charcoal Iron Blooms and Billets.

The production of iron blooms, billets and bars in charcoal bloomaries from pig iron or from pig iron and scrap, for the consumption of the makers or for sale, amounted in 1908 to 55,973 tons, against 84,623 tons in 1907 and 94,999 tons in 1906. Similar statistics for 1905 and preceding years were not collected. All the iron blooms, slabs, billets, and bars reported for 1908 were made with charcoal as fuel, but of the total in 1907 about 4,513 tons were made with natural gas alone and natural gas and charcoal. Of the total production in 1908, 47,870 tons were for the consumption of the makers and 8,103 tons for sale, against 67,069 tons for the consumption of the makers and 17,554 tons for sale in 1907. In 1906 there were 77,166 tons made for the use of the makers and 17,833 tons for sale.

Production of Nail Plate.

The production in the United States of iron and steel plate for the manufacture of cut nails and cut spikes in 1908 amounted to 45,747 tons, against 52,027 tons in 1907, a decrease of 6,280 tons, or over 12 per cent. Of the total production in 1908 about 30,265 tons were steel and about 15,482 tons were iron, against about 36,932 tons of steel and about 15,095 tons of iron in 1907, a decrease in steel nail and spike plate of 6,667 tons but an increase in iron nail and spike plate of 387 tons.

Plates and Sheets.

In 1908, the production of iron and steel plates and sheets, excluding nail plate, amounted to 2,649,693 tons, against 4,248,832 tons in 1907, a decrease of 1,599,139 tons, or over 37.6 per cent.

In 1908 there were 117 works in 15 states which rolled plates or sheets, against 134 in 17 states in 1907 and 134 in 16 states in 1906.

Miscellaneous Rolled Forms.

The association has ascertained from the manufacturers the production in 1908 of merchant bars, skelp, spike rods, bolt rods, splice bars, hoops, bands, cotton-ties, strips, rolled axles, rolled armor plate, and other forms of finished rolled iron and steel for which statistics have not been given in the annual report. Rolled forging blooms and forging billets are included from 1905, but forged armor plate, hammered axles, and other forgings are not included.

In 1908 the production of the articles above enumerated amounted to 4,311,608 tons, as compared with 7,972,374 tons in 1907, a decrease of 3,660,766 tons, or over 45.9 per cent. Of the production in 1908 about 3,145,677 tons were steel and about 1,165,931 tons were iron, as compared with about 5,867,869 tons of steel and about 2,104,505 tons of iron in 1907, showing a decrease in steel products of 2,722,192 tons and in iron products of 938,574 tons.

Black Plates, Tinplates and Terne Plates.

The production of black plates, or sheets, for tinning in 1908 amounted to 513,771 gross tons, against 504,072 tons in 1907, an increase of 9,699 tons.

The production of cut nails and cut spikes in 1908 amounted to 956,182 kegs of 100 pounds each, against 1,109,138 kegs in 1907, a decrease of 152,956 kegs, or over 13.7 per cent.

The production of wire nails in 1908 amounted to 10,662,972 kegs of 100 pounds, as compared with 11,731,044 kegs in 1907, a decrease of 1,068,072 kegs, or over 9.1 per cent. Steel wire nails only were made in both years.

Total Production of Finished Rolled Iron and Steel.

The production of all kinds of iron and steel rolled into finished forms in 1908, including rolled forging blooms and rolled forging billets, amounted to 11,828,789 gross tons, against 19,864,822 tons in 1907, a decrease of 8,036,033 tons, or over 40.4 per cent. Of the total production in 1908 about 10,590,340 tons, or a little over 89.5 per cent, were rolled from steel and about 1,238,449 tons, or a little less than 10.5 per cent, from iron, as compared with about 17,664,736 tons, or almost 89 per cent, rolled from steel and about 2,200,086 tons, or a little over 11 per cent, rolled from iron in 1907. As compared with 1907 the decrease in rolled steel in 1908 amounted to 7,074,396 tons and in rolled iron to 961,637 tons.

SALES OF PORT HENRY ORES.

(Special Telegram.)

New York, May 26.—Substantial sales of Port Henry ore have been made within the past 10 days for delivery not later than Jan. 1. Reports are current that one lake interest has been offering its product at concessions from the established prices, but these are believed to refer to some off-grade ores.

SOUTHERN STEEL CO.

Has Been Reorganized—J. P. Morgan Jr. Succeeds H. H. Rogers.

(Special Telegram.)

New York, May 26.—The Southern Iron & Steel Co. has been organized as follows: W. H. Hassinger, president and chairman executive committee; James T. Woodward, vice president; W. W. Miller, secretary and treasurer; A. R. Forsyth, secretary executive committee; and assistant secretary and treasurer, D. G. Boissevain. The directors include the above and the following: Cornelius Vanderbilt, Alexis W. Thompson, Kenneth K. McLaren, Franklin Q. Brown, Robert B. Vancortlandt, Walter T. Rosen, C. S. Broughton, W. P. G. Harding, R. T. Wilson Jr., Wm. B. Denton, Cecil A. Greenfell and T. S. Kyle.

J. P. Morgan Jr. has been selected a member of the directors' board and of the finance committee of the United States Steel Corporation, succeeding the late H. H. Rogers.

The McClintic-Marshall Construction Co., Pittsburg, has taken 5,500 tons of bridge work for the Boston & Albany R. R. and 2,300 for the Sunnyside viaduct of the Pennsylvania Tunnel & Terminal Co. This city will require about 1,300 tons for new pier in South Brooklyn.

LONG-TERM COKE CONTRACT CLOSED.

(Special Telegram.)

Pittsburg, May 26.—The Thompson-Connellsville Coke Co. has closed a long term furnace contract with an independent steel company and affiliated interests, which, with full furnace operations, will require about 400,000 tons annually. The price has not been announced. It is reported that the term of the contract is five years. As a result of the closure of this large contract, the Thompson-Connellsville company has ordered construction work to be pushed on 400 beehive ovens, the foundations of which have already been built near Republic Station, Fayette county, Pa. The company has been operating 400 ovens.

A western Pennsylvania radiator interest has closed for 3,000 tons of foundry iron for extended shipment.

More Coke Ovens.—The Connellsville Central Coke Co. has begun the construction of 100 additional ovens of the longitudinal type at its Herbert plant near Uniontown, Pa.

OBITUARIES.

Daniel P. Marsh, manager of the Janesville Machine Co., died May 12, at Omaha, Neb., aged 65.

George Selsor, for many years a member of the company conducting the Germantown Tool Works, died at Germantown, Pa., May 12, aged 89.

Wm. R. Howell, a member of the iron and steel firm of Sloan & Howell, Philadelphia, died May 22. He was a graduate of the University of Pennsylvania, where he was a prominent athlete.

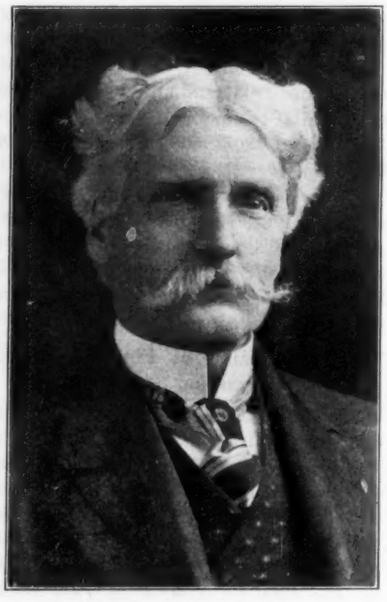
Cyrus B. True, who died recently at Roxbury, Mass., aged 81 years, was widely known throughout New England as an inventor of parts of sewing machines. In 1860 he invented a shuttle machine which proved to be very successful.

John M. Treble, a director of the Massey-Harris Co., Toronto, and vice president of the Sawyer-Massey Co., of Hamilton, died of heart failure while attending a board meeting of the former company, May 17, aged 64. Mr. Massey came to Canada from Devonshire, England, when quite young and was prominent in various business enterprises in Toronto and Hamilton.

Oscar H. Marschuetz, Louisville, Ky., superintendent of the Ahrens & Ott plant of the Standard Sanitary Mfg. Co., died at Cincinnati, May 19, where he was attending the convention of the American Foundrymen's Association. He had been with the Louisville plant for 22 years, and for the past few years had been a director in the Standard Sanitary Mfg. Co. Mr. Marschuetz was 55 years old and was born in Bremen, Germany.

The death of Rufus Kidder Wood, general agent of the Maryland Steel Co., occurred unexpectedly at his home at Sparrow's Point, Md., May 16. Two weeks before he had sustained a fracture of the right leg on board a sailing vessel and while he was undergoing treatment for this injury heart trouble developed. Mr. Wood was a brother of F. W. Wood, president of the Maryland Steel Co. Born 60 years ago at Lowell, Mass., he conducted a hardware store in Boston until 1887 when he went to Baltimore. There in connection with his brother he became identified with the Pennsylvania Steel Co.'s Maryland extension which afterward became the Maryland Steel Co., first in the position of cashier and purchasing agent and later as general agent. He was actively identified with every educational and municipal project that made for the betterment of the many employes of the plant by whom he was beloved. He had been honored by appointment on the state educational board by the governor of Maryland.

William Christie Herron died at his home in Avondale, Cincinnati, May 21, aged 66 years. Mr. Herron was born in Cincinnati. Although but 18 years of age when the civil war began, he enlisted in the navy and served throughout the war. At the close of the war, he returned to Cincinnati and took a position with the hardware firm of Howell, Gano & Co. A few years later, he became a member of the firm of Giren & Herron, at Dayton, O., and removed to that city. About 1886 he joined the selling force of Rogers, Brown & Co., and became a partner in the firm. On Dec. 31, 1902, he retired from active business life for a time because of ill health. At the time of his death he was a director in the



WILLIAM CHRISTIE HERRON.

Fifth-Third National Bank, of Cincinnati, O., the American Rolling Mill Co., at Middletown, O., and the Hanging Rock Iron Co., of Ironton, O. He was interested in many charitable institutions. Mr. Herron was an advocate of universal peace and spent much time in advocating work in this direction. He leaves two sons, George W. Herron, who is at present connected with Armour & Co., of Chicago, and stationed at Calgary, Alberta, Canada, and Mason P. Herron, who is secretary of the Hanging Rock Iron Co.

Thomas A. Weston, who died in New York City, May 3, aged 77, was for many years associated with the Yale & Towne Mfg. Co., Stamford, Conn., as mechanical engineer. He was born in England, but came to this country when quite young, and was a clerk in the old hardware house of Pratt & Co., Buffalo. Possessing an inventive turn of mind, he first invented the differential pulley block, an adaptation of the old "Chinese windlass," and a reduction of the mechanical problem to the simplest terms. The licensee in the United States of this invention was the Yale & Towne Mfg. Co. His next notable invention was that of the multiple disc brake, which has been used in various forms in which brake resistance is needed, especially in cranes and hoists. His third and last important invention was that embodied in the triplex chain block made by the Yale & Towne Mfg. Co. Beside making other minor inventions, Mr. Weston spent the latter part of his life in the study of mechanical problems.

H. M. LANE ACQUITTED.

Henry M. Lane was placed on trial in the common pleas court of Cuyahoga county at Cleveland on May 17, Judge Vickery presiding, on a charge of taking zinc, halftone and wax cuts from the Penton Publishing Co., which it was alleged had been carried away shortly before his connection with that concern was terminated in January, 1907.

After a part of the testimony for the state had been heard, the prosecuting attorney remarked that it was evident that the defendant had not been properly indicted. Judge Vickery concurred in this opinion, stating that if any crime had been committed, it was embezzlement and not larceny, as charged in the indictment. He added that the evidence submitted was not strong enough to convict on the charge of embezzlement; hence he instructed the jury to return a verdict of not guilty, which was accordingly done and the defendant discharged.

On page 904 of the issue of THE IRON TRADE REVIEW of May 13, referring to the electric furnace pig iron experiments in California, in the third column, sixteenth line, it was stated that the consumption of charcoal is 1 1/3 tons, whereas the article should have stated 1/3 ton of charcoal per ton of pig iron.

The Rinconada Mining Co. of Poto, Peru, with an office at 220 Broadway, New York, is in the market for a list of compressors and other mining equipment.

New York City announces the offering of $40,000,000 4 per cent stocks and bonds, of which $10,000,000 will be devoted to water supply purposes.

PIG IRON SPECIFICATIONS AGREED UPON

AT THE CONVENTION OF THE AMERICAN FOUNDRYMEN'S ASSOCIATION.

Valuable Papers Read and Discussed—Creditable Exhibits of Foundry Supplies—Detroit Will Probably be Next Place of Meeting—Proceedings of Allied Associations.

Possibly the most important work accomplished at the convention of the American Foundrymen's Association held in Cincinnati last week was the adoption of standard specifications for the buying of foundry pig iron. These were submitted by the committee appointed at the Toronto convention last year, and represented the joint efforts of the American Foundrymen's Association committee, and committees from the American Society for Testing Materials, the Philadelphia Foundrymen's Association and the Eastern Pig Iron Association. H. E. Field, Pittsburg; Henry A. Carpenter, Providence, and Stanley G. Flagg Jr., Philadelphia, comprised the American Foundrymen's Association representation. The report was not received without some sharp criticism from the furnace and commercial laboratory interests, but it finally prevailed and was adopted without change. The full report is as follows:

PROPOSED STANDARD SPECIFICATIONS FOR BUYING FOUNDRY PIG IRON.

It is recommended that foundry pig iron be bought by analysis, and that when so bought these standard specifications be used.

PERCENTAGES AND VARIATIONS.

In order that there may be uniformity in quotations, the following percentages and variations shall be used.

(These specifications do not advise that all five elements be specified in all contracts for pig iron, but do recommend that when these elements are specified that the following percentages be used.)

SILICON.

(0.25 allowed either way)

	(Code)
1.00	(La)
1.50	(Le)
2.00	(Li)
2.50	(Lo)
3.00	(Lu)

SULPHUR.

(Maximum)

	(Code)
0.04	(Sa)
0.05	(Se)
0.06	(Si)
0.07	(So)
0.08	(Su)
0.09	(Sy)
0.10	(Sh)

TOTAL CARBON.

(Minimum)

	(Code)
3.00	(Ca)
3.20	(Ce)
3.40	(Ci)
3.60	(Co)
3.80	(Cu)

MANGANESE.

(0.20 either way)

	(Code)
0.20	(Ma)
0.40	(Me)
0.60	(Mi)
0.80	(Mo)
1.00	(Mu)
1.25	(My)
1.50	(Mh)

PHOSPHORUS.

	(Code)
0.20	(Pa)
0.40	(Pe)
0.60	(Pi)
0.80	(Po)
1.00	(Pu)
1.25	(Py)
1.50	(Ph)

Percentages of any element specified one-half way between the above shall be designated by addition of letter to next lower symbol.

In case of phosphorus and manganese, the percentages may be used as maximum or minimum figures, but unless so specified they will be considered to include the variation above given.

Sulphur, Per Cent	Silicon Per Cent 3.25	3.00	2.75	2.50	2.25	2.00	1.75	1.50	1.25	1.00
0.04	B+6C	B+5C	B+4C	B+3C	B+2C	B+1C	B	B—1C	B—2C	B—3C
0.05	B+5C	B+4C	B+3C	B+2C	B+1C	B	B—1C	B—2C	B—3C	B—4C
0.06	B+4C	B+3C	B+2C	B+1C	B	B—1C	B—2C	B—3C	B—4C	B—5C
0.07	B+3C	B+2C	B+1C	B	B—1C	B—2C	B—3C	B—4C	B—5C	B—6C
0.08	B+2C	B+1C	B	B—1C	B—2C	B—3C	B—4C	B—5C	B—6C	B—7C
0.09	B+1C	B	B—1C	B—2C	B—3C	B—4C	B—5C	B—6C	B—7C	B—8C
0.10	B	B—1C	B—2C	B—3C	B—4C	B—5C	B—6C	B—7C	B—8C	B—9C

SAMPLING AND ANALYSIS.

Each car load, or its equivalent, shall be considered as a unit in sampling.

One pig of machine-cast, or one-half pig of sand cast iron shall be taken to every four tons in the car, and shall be so chosen from different parts of the car as to represent as nearly as possible the average quality of the iron.

Drillings shall be taken so as to fairly represent the composition of the pig as cast.

An equal weight of the drillings from each pig shall be thoroughly mixed to make up the sample for analysis.

In case of dispute, the sample and analysis shall be made by an independent chemist, mutually agreed upon, if practicable at the time the contract is made.

It is recommended that the standard methods of the American Foundrymen's Association be used for analysis. Gravimetric methods shall be used for sulphur analysis, unless otherwise specified in the contract.

The cost of resampling and reanalysis shall be borne by the party in error.

BASE OR QUOTING PRICE.

For market quotations an iron of 2.00 per cent in silicon (with variation of 0.25 either way), and sulphur 0.05 (maximum), shall be taken as the BASE.

PENALTIES.

In case the iron, when delivered, does not conform to the specifications, the buyer shall have the option of either refusing the iron, or accepting it on the basis shown in the above table, which must be filled out at the time the contract is made.

ALLOWANCES.

In case the furnace cannot for any good reason deliver the iron as specified at the time delivery is due, the purchaser may at his option accept any other analysis which the furnace can delivery, the price to be determined by the base table above, which must be filled out at the time the contract is made.

BASE TABLE.

The following table may be filled out, and may become a part of the contract: "B," or Base, represents the price agreed upon for a pig iron running 2.00 in silicon (with allowed variation of 0.25 either way) and under 0.05 sulphur. "C" is a constant differential to be determined at the time the contract is made.

(This table is for settling any differences which may arise in filling a contract, as explained under penalties and allowances, and may be used to regulate the price of a grade of pig iron which the purchaser desires, and seller agrees to substitute for the one originally specified.)

Silicon percentages allow 0.25 variation either way. Sulphur percentages are maximum.

Report Discussed.

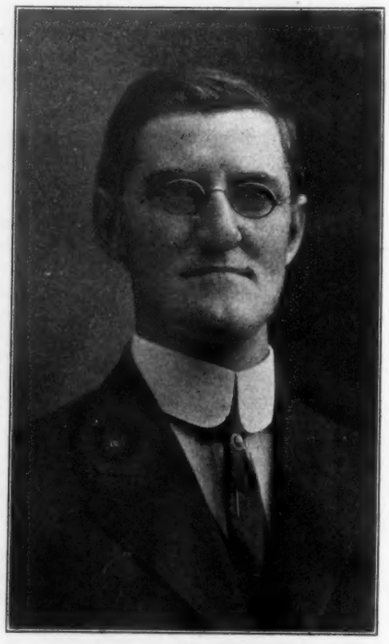
Eliot A. Kebler, manager of sales, Matthew Addy & Co., opposed the adoption of the report without more thorough discussion of the various phases of it. He stated that the adoption of the gravimetric method for sulphur determinations was a most serious change from the usual practice, as practically all the furnaces and many of the commercial chemists determine their sulphur volumetrically and the latter is used by a majority of the foundries in making their mixtures. "The absurdity of the gravimetric method," he said, "is seen when for instance a furnace ships a customer an iron running 0.045 sulphur volumetrically and the customer rejects the same because the chemist might find 0.055 sulphur by the gravimetric method in the same iron. The gravimetric method should not be adopted as a standard until the foundrymen are willing to receive an apparent higher sulphur on their contract if this method is used. In

addition, it has not yet been proven that an iron which shows volumetrically sulphur 0.045 and gravimetrically 0.055 is a poorer iron than one which shows 0.045 by both methods. In proposing a specification it should be borne in mind that pig iron is made by charging large quantities of ore, limestone and coke of varying analyses in the top of a furnace and this is not seen until it runs from the bottom as molten pig iron, and even with the best skill that can be purchased there will still be a great variation in the product, and if specifications are drawn so closely that only a small portion is considered standard, this must be sold at a relatively high price to offset the lower price at which the balance must be sold because under the proposed gravimetric specifications this balance might be penalized on account of high sulphur shown. Under the percentage and variations table an allowance in silicon is permitted of 0.25 either way. If this table was adopted as shown, and a customer ordered 2 per cent silicon and a car of iron analyzing exactly 2 per cent is shipped on the order, the customer might pay for this as under contract price or at the price of 2.25 silicon or at the price of 1.75 silicon, as this determination would come in the first instance exactly on the standard and in the last two cases within the allowed variation of the other two grades. This same suggestion applies to the manganese where the allowance is exactly the same as the difference between the different grades. As carbons are very rarely determined, it would be well to omit the carbon from the specifications."

E. J. Stoddard, of the Detroit Testing Laboratory, said it was unnecessary to split hairs in the average foundry over a 5/1,000 in the sulphur and inasmuch as nearly all commercial laboratories used the evolution method, he disapproved the idea of specifying any method. Furthermore, that the foundrymen would not pay for a gravimetric determination.

Dr. Moldenke replied that merely because a method was in general use was no reason why the association should sanction its continuance when it knew the same was wrong. He said there ought to be two prices for the volumetric and gravimetric, to which Mr. Stoddard answered that it was enough to collect for the present relatively cheap system.

H. E. Field, of Pittsburg, chairman of the committee proposing the specifications, in answer to the objections raised to the report, said "the committee recognized the fact that the slight extra expense would be caused the furnaces in adopting the gravimetric method and gave this due consideration, but considered that this extra expense was absolutely necessary. Every iron differs in the proportion of sulphur that is evolved. This difference is practically constant in each brand of iron and it would be very little trouble for the furnace to fix its own differential and sell on the gravimetric basis. It could analyze its iron volumetrically and have a gravimetric method by its own chemist or by some reputable chemist once in a while. The specifications submitted took this into account and made the gravimetric method optional with the signers of the contract. Should the founder be assured that the iron he was buying gave all the sulphur by the evolution method, he could accept the evolution method in the contract. This question is so important that the committee gave months of consideration to it, and came to the conclusion that the only way of making the specifications in any way suitable and lasting was to adopt the gravimetric method. In regard to the question of variation in silicon mentioned by Mr. Kebler, the questions in the final report will take care of these."



ARTHUR T. WATERFALL,
President American Foundrymen's Association.

Major Speer, of Pittsburg, believed the report ought to be adopted and if the commercial chemists could not make a gravimetric analysis, they should be educated to do so.

The report was then adopted.

Officers Elected.

The officers elected for the ensuing year are as follows:

AMERICAN FOUNDRYMEN'S ASSOCIATION.

President, Arthur T. Waterfall, Russel Wheel & Foundry Co., Detroit.

Vice presidents: 1st district, F. B. Farnsworth, McLagon Foundry Co., New Haven, Conn.; 2d district, Walter Wood, R. D. Wood & Co., Philadelphia, Pa.; 3d district, Joseph T. Speer, Pittsburg Valve Foundry & Construction Co., Pittsburg; 4th district, Eugene W. Smith, Crane Co., Chicago; 5th district, Thos. W. Sheriffs, Sheriffs Mfg. Co., Milwaukee, Wis.; 6th district, Alf. E. Howell, Phillips & Buttorf Mfg. Co., Nashville, Tenn.; 7th district, William Gilbert, Buckeye Foundry Co., Cincinnati, O.; 8th district, A. F. N. Clare, Clare Stove Co., Preston, Ont.

Secretary and treasurer, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN BRASS FOUNDERS' ASSOCIATION.

President, William R. Webster, Bridgeport Brass Co., Bridgeport, Conn.

Vice presidents: (Rolling mill department)—Ed. O. Goss, Scovill Mfg. Co., Waterbury, Conn. (Brass foundry, plating and polishing departments)—A. H. Warner, Stebbings Mfg. Co., Springfield, Mass; W. L. Abate, Nathan Mfg. Co., New York city; Thomas Evans, Eynon & Evans Mfg. Co., Philadelphia; L. W. Olsen, Ohio Brass Co., Mansfield, O.; J. N. Gamble, National Tube Co., Kewanee, Ill.; W. D. Allen, Allen Mfg. Co., Chicago; J. Cessna Sharp, John C. Sharp Brass Works, Chattanooga; N. K. B. Patch, Lumen Bearing Co., Toronto, Can.; Richard R. Mitchell, R. E. Mitchell Co., Montreal, Que.

Secretary and treasurer, W. M. Corse, Michigan Smelting & Refining Co., Detroit.

ASSOCIATED FOUNDRY FOREMEN.

President, Eugene W. Smith, Chicago (Crane Co.).

First vice president, W. F. Grunan, Erie, Pa. (Erie City Iron Works).

Second vice president, J. L. Marshall, Milwaukee (Geo. H. Smith Steel Casting Co.).

Secretary and treasurer, C. E. Hoyt, Lewis Institute, Chicago.

FOUNDRY AND MANUFACTURERS SUPPLY ASSOCIATION.

President, F. N. Perkins, Arcade Mfg. Co., Freeport, Ill.

First vice president, F. B. Stevens, Frederic B. Stevens, Detroit.

Second vice president, R. S. Buch, A. Buch's Sons Co., Elizabethtown, Pa.

Third vice president, S. T. Johnston, S. Obermayer Co., Chicago.

Fourth vice president, Wm. Lodge, Lodge & Shipley Machine Tool Co., Cincinnati; secretary-treasurer, C. E. Hoyt, Lewis Institute, Chicago.

Trustees, three-year term—E. A. Pridmore, H. E. Pridmore, Chicago; George H. Wadsworth, Falls River & Machine Co., Cuyahoga Falls, O.; H. R. Atwater, Osborn Mfg. Co., Cleveland, and E. J. Woodison, Detroit Foundry Supply Co., the last named being elected to fill the unexpired term of S. T. Johnston.

Steel Founders' Organization.

Before the close of the last session of the American Foundrymen's Association body, announcement was made by the secretary that he had been approached by several steel founders with the suggestion that an organization, educational in scope, be organized along the lines of the other affiliated bodies. No action was taken, however, other than that the request be referred to the executive committee, several protests to the suggestion having been made because of the existence of an organization with similar aims in view.

The resolution was unanimously adopted that another ballot vote be taken during the year on the question of increasing the dues in the American Foundrymen's Association from $5 to $10, and that if two-thirds of those voting were in the affirmative, the increase to be adopted.

Committee on Castings.

The motion was passed that John Jermain Porter, of the University of Cincinnati, who read a paper on "The Practical Value of Chemical Standards for Iron Castings," should be appointed chairman of a committee, with power to select his own associates, for the purpose of "classifying castings according to the physical properties which are of importance in them, and then to tabulate the chemical compositions which are found suitable for each class." Mr. Porter made this suggestion in the closing paragraphs of his paper, adding that "it would also be highly desirable to take some cognizance of the factor of the cost of the mixture and show, where possible, how the foundryman could cut down the cost of his iron without decreasing the quality of his product."

As is customary, L. L. Anthes, of Toronto, the retiring president, was made an honorary member of the association. A vote of thanks was also passed to the local entertainment committee, authors of papers and retiring officers.

Invitations were read by Frank T. F. Stephenson, of Detroit, inviting the association to meet in Detroit in 1910, and by Joseph Spe r, of Pittsburg, inviting the association to that city in 1911, both of which were referred to the executive committee for action.

EUGENE W. SMITH,
President Associated Foundry Foremen.

Associated Foundry Foremen.

The business session of the Associated Foundry Foremen was held Wednesday evening, May 19. The report of the secretary and treasurer showed:

Balance on hand, July 13, 1908.	$309.85
Received from dues.....	220.00
	$529.85

After payment of all bills due to date, there was a net balance in the treasury of $294.08.

Mr. Hoyt was reluctant to accept the secretaryship for another year, because of the large amount of labor involved, the unsatisfactory co-operation of the members and because of the confusion existing growing out of the failure of the constitution and by-lays to provide for the changed conditions that had arisen since the organization was founded. After considerable discussion, it was finally decided to appoint a committee of five, composed of Messrs. Everitt, Perrine, Marshall, Becker and Kettelson to draw up a new constitution and by-laws. This will be submitted to the association for adoption by a letter ballot vote; and inasmuch as it is intended to entrust greater powers to the secretary, Mr. Hoyt consented to the proposal of his name as secretary and treasurer, and he was renominated with loud approval.

Opening Session, Tuesday Afternoon.

The report of the committee on industrial education was read by P. Kreuzpointner, Altoona, Pa., chairman. It very ably reviewed social and industrial conditions, and suggested a system of industrial continuation schools, serving general industrial purposes up to 16 years of age, and then becoming specified trade schools. These schools to be supported by both the state and the community, making attendance compulsory up to 15 years of age, and the employer recognizing the increased intelligence by a better wage which will induce parents to send their children to school instead of to the factory. The committee urged that the American Foundrymen's Association co-operate with the American Society for the Promotion of Industrial Education in the work which the latter is doing.

Wednesday Morning Session.

At this session, Acting Chairman Webster announced the names of the committee, suggested by Secretary Corse the previous day, to co-operate with representatives of the American Chemical Society and the United States bureau of standards in the compilation of standard methods of analysis for brass and kindred alloys. They are: W. M. Corse (who also represents the American Chemical Society), E. S. Sperry, Bridgeport, Conn., and A. D. Little, chemist, Boston, Mass. Dr. W. F. Hillebrand is the government representative.

Various Papers.

The paper entitled "The Manufacture of Brass Ingots; Their Uses and Advantages," by W. M. Corse, Detroit, was read by the author.

The paper on "Waste Heat," by F. W. Reidenbach, manager Genesee Metal Co., Rochester, N. Y., was next taken up. The author had no

suggestions to make, confining himself to calling attention to the great losses resulting from the failure to secure full value from the combustible materials used in melting various metals. In the company with whicl he is connected, he said they maintained a steam heating plant which heated their entire offices with the waste heat of two No. 22 crucible furnaces at an annual saving of $300 in fuel.

Mr. Corse told of the experience of the General Electric Co. in utilizing the waste heat from seven Schwartz furnaces. They installed a 100-inch fan and heating coils, hoping to provide heat for their other

F. N. PERKINS,
President Foundry and Manufacturers' Supply Association.

buildings, but have since taken the plant out.

"The Patent Situation in the United States Respecting Alloys," by C. H. Clamer, was read by Dr. Stevenson, no copies having been printed and the author not being present. The paper devoted itself principally to a review of the suit brought by the Ajax Metal Co. against the Brady Brass Co. for infringement of a copper-tin-lead alloy patent.

"The Side Blow Converter for Steel Castings, and Its Operation," by J. S. Whitehouse, of the Bonney-Floyd Co., Columbus, O., was the next paper taken up. After reviewing the failures resulting from ignorance in operation, Mr. Whitehouse said that "with proper blowing the main loss comes from the silicon in the charge, usually 2 per cent, which is oxidized along with the iron and manganese to form the slag. * * * * Another advantage is the increase in the amount of scrap which can be carried, and which helps to cut down the cupola loss by increasing the carbon in the charge. For example: I charge 50 per cent of pig with about 3.75 per cent carbon, and 50 per cent scrap with 0.25 carbon. Tests of the cupola iron ran 3.25 per cent carbon, a gain of 1.25 to 1.50 per cent of carbon taken from the coke instead of bought in the form of pig iron. Regardless of what has been written, 50 per cent of scrap can be melted in the cupola with good results and using only 12½ per cent of coke, but your blower must have a complete knowledge of cupola practice. With ordinary care, the steel produced in a converter is very uniform in carbon and silicon, more so than in open-hearth. The greatest variation seems to be in manganese, the temperature of the metal and the condition of the slag causing more of a variation than in acid openhearth practice."

In answer to a question of why he used so much scrap, Mr. Whitehouse said it was done to avoid getting the steel too hot, as a very hot iron had a tendency to burn the sand in and make castings more difficult to clean.

The paper entitled "Notes on Air Furnace Construction for Malleable Castings," by W. H. Kane, was read by title. So was the paper entitled "Use of Pulverized Coal for Foundry Purposes," by Richard K. Meade. The question was asked after this paper was opened for discussion if coal had been used in cupolas, to which Dr. Moldenke said not to his knowledge, although oil had been used in this connection in Germany, which to get quick composition in a high temperature showed great possibilities.

"Machine Molding vs. Hand Molding," by George Muntz, of West New Brighton, N. Y., was next read. The meeting adjourned without any discussion of this paper.

Wednesday Afternoon.

"The Cost of Steel Melting in Foundries," by Dr. Bradley Stoughton, illustrated with lantern slides, was the first taken up. This paper went very fully into the costs of the crucible, converter, open-hearth and electric processes, and proved one of the most interesting papers of the entire series. This paper was not presented in printed form, Dr. Stoughton reading from memory and manuscript. One of the questions asked the author was if it would be possible to melt in the cupola and transfer the metal to the electric furnace for refining. The answer to this was that it could be done in the large sizes of electric furnaces, though these cost a very large amount. The cost sheets showed on the curtain by Dr. Stoughton indicated that the electric furnace was the cheapest method of producing steel. In answer to a question as to what was included in operating costs, he said that they included overhead charge, insurance, interest on investment, depreciation. Because of its very great importance, this paper will be printed fully in an early issue of THE IRON TRADE REVIEW.

WILLIAM R. WEBSTER,
President American Brass Founders' Association.

No discussion followed the reading of the paper entitled "The Heart of the Foundry as Seen by the Foundry Engineer," by D. S. Hawkins.

S. D. Sleeth, of Pittsburg, followed with his paper entitled "Continuous Melting in Foundry of Westinghouse Air Brake Company." This method has been fully described in the past; nevertheless, the paper proved one of the most interesting of the convention, and Mr. Sleeth was kept on the stand answering questions for an hour or more. Every detail of information regarding the system of sand conveying; the construction, speed and operation of the pouring table; the placing of cores, the number of men em-

(Continued on page 979.)

HEARTY WELCOME EXTENDED TO AMERICANS

AT THE MEETING OF THE IRON AND STEEL INSTITUTE IN LONDON.

Discussion of the Electrolytic Theory of Corrosion—Bessemer Medal Conferred—Tribute to the Late Bennett H. Brough—Opinions on Uses of the Electric Furnace

The interest of the opening day at the spring meeting of the Iron and Steel Institute in London on Thursday, May 12, may be said to have been dominated by Americans, inasmuch as nearly the whole of the proceedings consisted of the reading and discussion of American papers.

The success with which America held the stage was due to the admirable contribution by Prof. Cushman, whose paper will be referred to later.

Sir Hugh Bell, president, occupied the chair, and the meeting took place as usual in the excellent room of the Institution of Civil Engineers, Westminster, once more placed at the disposal of the institute. The gathering was favored by the most charming weather. The large attendance included two former presidents, E. Windsor Richards and E. P. Martin, and the following vice presidents, W. Beardmore, A. Cooper, A. T. Tannett-Walker, Percy Gilchrist, F. R. S., and members of the council as follows, A. Lamberton, W. H. Hewlett, C. J. Bagley, J. C. Cunninghame, J. E. Stead, F. R. S., W. Evans, J. M. Gledhill and G. Ainsworth.

There were a number of foreign members present, America being represented by Prof. Allerton Cushman, assistant director, office of public roads, United States department of agriculture.

The opening proceedings were briefer than usual, owing to the fact that Sir Hugh Bell occupies the position for the third year, through the inability of Sir William Thomas Lewis to carry out his promise announced at the autumn meeting last year to accept the presidency. No presidential address was therefore delivered.

Sir Hugh expressed his regret that at the last moment Sir William Thomas Lewis found it impossible to accept the presidency, which they deeply deplored, because so distinguished a member would have added luster to the office. He had reluctantly consented to be acting president for another 12 months, although a third year presidency was an unparalleled position. But it was a special satisfaction to him to announce that he would be followed in the chair by the Duke of Devonshire, a very distinguished man of science, occupying a prominent position in the iron world. His grace had accepted the invitation, and would adorn the position. He would remind them that the grandfather of the duke was the first president of the institute.

Tribute to Bennett H. Brough.

Sir Hugh, speaking with some emotion, called attention to the fact that he had no longer, sitting at his right hand, the secretary who for so many years had energetically guided the affairs of the Institute. It might be said that Bennett H. Brough died at his post and in harness. The fatal illness seized him during the Middlesboro meeting which he did so much to organize and which was one of the most brilliant meetings that the institute had ever enjoyed. The illness came while the meeting was in full swing, but they then hoped that the valuable life might have been spared. Personally, from the first, he took a grave view of the case and the day after the meeting, Mr. Brough's career ended by death. They had lost a most valued servant and a most faithful secretary who set before himself always the interests of the institute. They would all desire to testify their regard by recording their regret at his death.

On the invitation of Sir Hugh, the members rose to their feet, passing, in silence, a vote of condolence. The president promised to convey that expression to Mrs. Brough and family. He added that they had been fortunate in securing as successor the services of Mr. Lloyd, who was for some time in the office of the Institute, and he hoped that many years hence Mr. Lloyd might look back upon service as distinguished and faithful as that rendered by his predecessor. Referring to the Brough fund, the president said he hoped it would place the children in that position which Mr. Brough himself, with his high sense of what was due to them, would have desired.

Report of Council.

The report of the council was next received. It recorded that the year had been one of considerable activity and progress. They had added 116 new names, making the present total 2,128 a considerable increase on the year. A long list of distinctions earned by members, was detailed, among which was the election of Sir Hugh Bell and Sir Thomas Lewis, as members of the Board of Trade Arbitration Court; the honor of knighthood conferred on R. A. Hatfield; the bestowal of the degree of doctor of laws upon Andrew Carnegie by the University of Manchester; the appointment of G. B. Waterhouse, professor of metallurgy at the University of Buffalo, and many others. Mention was made of the death of 41 members, including names of well known repute, such as the Duke of Devonshire, the first president, Dr. Hermann Wedding, A. Baldwin, M. P., and Dr. Sorby. Satisfaction was expressed at the financial prospect of the institute, the receipts amounting to £6,367 and the expenditures £6,011. Acknowledgement was also tendered to J. A. Amos, honorary secretary of the Middlesboro reception committee, who so greatly contributed to the success of that meeting, and a piece of jewelry had been presented to his wife, with acknowledgements of their excellent services.

The fund established on behalf of Mr. Brough's family to assist his widow and children should suffice for carrying into execution the scheme contemplated by the council.

During the year, the offices had been enlarged, and numerous presentations, in the way of books and pictures, had been made, the collection of portraits of presidents and Bessemer medalists having been enriched by an artistically executed portrait in oils of Andrew Carnegie, past president, presented by that gentleman. Members are invited to present photographs in cabinet size for the institute album.

Special thanks were tendered to the Canadian Institute of Mining Engineers for the kindness and hospitality shown by the council of that institute as members of the Iron and Steel Institute at the summer meeting. Thanks were also tendered to the Cobalt branch of the Canadian institute for the collection of Canadian minerals presented to the Institute and

now on view in its library. Particulars were given of the Institute investments and of those in connection with the Andrew Carnegie research scholarship.

The report having been approved a hearty vote of thanks was accorded to Sir Hugh Bell on the proposition of H. G. Turner, London, seconded by W. H. Dixon, Glasgow. The former speaker specially mentioned the services rendered by Sir Hugh in connection with the metallurgical section of the Franco-British exhibition.

The scrutineers, J. Harrison, of Glasgow, and C. A. Ablett, London, annouced the re-election of the following members of the council: Vice presidents, A. Cooper, J. Rowley and A. T. Tannett-Walker; members of council, W. H. Ellis, W. Hewlett, A. Lamberton and C. P. Schneider. J. C. Cunningham had been elected in the place of D. Colville, resigned.

The meeting approved several alterations in the by-laws, announced at the Middlesboro meeting.

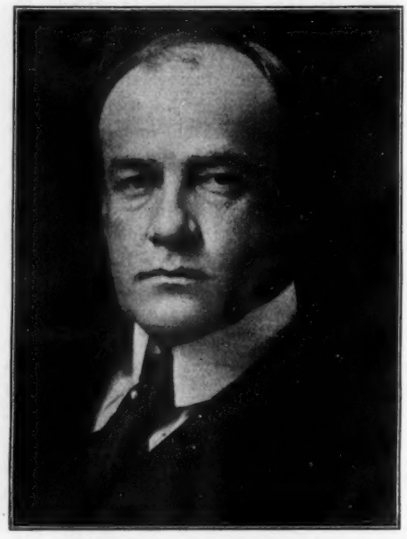
Two Papers by Americans.

This concluded the preliminary business and the meeting proceeded to consider some of the papers. In the absence of W. H. Walker, of Boston, U. S. A., the secretary read an abstract of his paper on "The Electrolytic Theory of the Corrosion of Iron and Its Applications." This was followed by a paper by Allerton Cushman on "The Preservation of Iron and Steel." The two papers being considered together, as dealing with kindred topics.

Mr. Cushman, who was a most able speaker, and had a remarkably cordial reception, was warmly welcomed by the president, who remarked that Americans now thought no more of crossing from the states than of coming in from an adjoining station. Mr. Cushman had arrived at the very moment he promised. "That," remarked Mr. Cushman, "is due to the excellence of your English ships." Sir Hugh Bell laughingly replied, "On behalf of Great Britain I acknowledge that American compliment."

Prof. Cushman, preferring to leave his paper in its full printed form, in the hands of the members, devoted his speech to a general consideration of the subject of the necessity to secure economy in the use of the world's material, giving at the same time some details of his own labors on the question. The meeting, he said, would have noticed the similarity in the way both he and Mr. Walker had presented their views on the subject of corrosion. Both of them five or six years ago, together started independent investigations. Being intimate friends they discussed the subject whenever they met, and arrived at the same conclusion. After describing some of his chemical experiments, the speaker insisted on the great importance of securing absolute cleanliness as the first essential in any attempts to prevent rust. They had always noticed that certain points were attacked more severely than others and the question of cleanliness was one explanation. Prof. Cushman went on to show how, having discovered positive nodes, they proceeded to obtain, with great success, negative nodes. The next point in the speech declared that the economizing of material and the conservation of natural resources was one of the most important subjects that could engage the mind of man.

He spoke not as a citizen of any



DR. ALLERTON S. CUSHMAN,
United States Department of Agriculture.

country, but as an inhabitant of the planet. If the present insane riot of waste continued, the time was not far distant when their children or children's children would find themselves in a very difficult situation, in the carrying on of the processes of civilization. In particular, they greatly needed some discovery in the way of perfectly protecting the surfaces of iron, perhaps that might be an ideal discovery but it would be of the greatest possible value to the human race. Whether such a non-rustible material would ever be found he would not like to prophesy; but he would point out that there were a number of steel alloys which were practically non-rustible. High nickel steels were uncorrodable. The same was true of high silicon irons, and if it were possible to siliconize the surface of prepared steel, that might meet the difficulty. He merely mentioned this that workers should direct their thoughts along those lines. It was quite a doubtful possibility; but he hoped it would be followed up by experiments. The speaker detailed at some length various chemical experiments for testing electrolytic action, and then dealt with linseed oil as a protector of iron and steel. All knew that it was not an ideal vehicle for the mixing of pigments; but it was the best of which they happened to know. Its disadvantage was that it absorbed water like a sponge, and in fact, was never dry. Whether it absorbed more or less water depended upon the condition of the atmosphere. The worst thing they could put upon the surface of steel was anything which served as a good conductor of electricity. They must in their prime coat use insulating materials. The fact was that engineers all over the world had been carefully selecting the most poisonous materials they could possbly pick out to apply to the surface of steel.

It was quite clear that the world-wide agitation showed the unsatisfactory methods now in operation for protecting materials, and they knew quite well that when corrosion started it was very much harder than at first to deal with the surface, however much they might clean it. The great thing was to protect it at first. The test he evolved had led to the discovery of a pigment which was being used in America, by engineers in all directions. They had over 600 large steel plates being tested in the Atlantic ocean and New Jersey, and a number of wire experiments were going on at Pittsburg, and they did not mean to drop the subject until they were assured whether their laboratory investigations would lead to correct application in practice. The theories had also been found valuable by tinners, paint manufacturers, tin can manufacturers, and galvanizers in iron and steel works, so that many things had been pointed out in ordinary metallurgical processes which were incorrect. He hoped that new methods would be found applicable to the preservation of all kinds of iron and steel.

The speaker was heartily applauded on resuming his seat.

An Interesting Discussion.

A third paper by J. Cruickshank Smith, B. Sc., F. C. S., on "The Value of Physical Tests in the Selection and Testing of Protective Coatings for Iron and Steel," was read in abstract by the secretary, Mr. Lloyd, in the

absence of the author, and J. E. Stead, of Middlesboro, then opened a most interesting discussion. Mr. Cushman, said the speaker, had allowed him to make experiments in the presence of the meeting, with some of the jelly which was described in the paper, had been used as a re-agent. The speaker then took a number of nails and sandwiched them between round slabs of jelly. He explained that they were to be left until the following day, but all would see very quickly the development on the edge of the pink color, which Mr. Cushman had led them to expect.

(It may be interjected here that long before the close of the meeting the cloudy pink appearance anticipated had already developed.) Continuing, Mr. Stead said, "the nails were not being specially prepared," and the speaker called attention to a series of large colored diagrams hung behind the chairman, to illustrate the paper. They must congratulate and thank those gentlemen for that very beautiful and practical method of illustrating the electrolytic action going on with iron and steel. They were beautiful enough to be called drawing room experiments. By way of illustratng the necessity for cleanliness, Mr. Stead said that if they only tested a needle which had passed through the thumb and finger, they would see immediately the affect of the slight trace of chloride of sodium left on the surface of the needle, and that would help them to understand the enormous effect on ship bottoms of their passage through sewage water, which carried a considerable amount of iron in suspension. It might retard corrosion if they could take away carbon, but that was quite impossible. It was always the outside layers of the ingots of steel that were more homogeneous, yet that did not prevent corrosion.

Referring to some experiments by Mr. Walker, the speaker said he had found less pitting of tin plate in English than in American material. (Laughter.) It might perhaps be that Mr. Walker deliberately selected the worst material on purpose. A very significant fact in regard to the application of protectors was shown by the painting of hot plates. They were aware that in steel works marks were often painted on plates when the latter were hot, and 10 or 12 years afterwards when the rest of the plates were corroded, those paint marks were still intact; that clearly showed that the oil was more effective when applied in a hot condition, which entirely excluded all moisture. The speaker concluded by heartily thanking Mr. Walker for having brought before them such a beautiful method of illustrating the phenomena in the corrosion of iron and steel.

Grateful to Cushman.

E. H. Saniter, Rotherham, suggested that the analyses should include investigation in regard to the arsenic, silicon, nitrogen, chromium and ferrous oxide, and other material.

Prof. Turner, of Birmingham, said that after reading Dr. Cushman's papers in various American journals, he was very grateful for the opportunity of making his personal acquaintance. No doubt the presence of small quantities of material on the surface of metal had a great effect on corrosion. He quite agreed also in the great importance of having the oil or other material thoroughly dried before its application. He knew how much better and more effective oil was when

PROF. W. H. WALKER,
Massachusetts Institute of Technology.

thoroughly well boiled, and the same was true of tar. He would like to say on behalf of English workers how greatly they were interested in Dr. Cushman's work.

G. H. Strick, of Cefnithin, Wales, urged the importance of securing perfect freedom from impurities of any metal to be submitted to tinning. It was particularly necessary to keep the metal free from slag and cinder.

Mr. Willcox (Sunderland) described some experiments with celluloids which he said proved very effective in the treatment of propellers.

Mr. Cushman, replying to the discussion, said that in connection with the American Society for Testing Materials he told the American manufacturers, some time ago, that if they would pay more attention to quality and less to quantity, that they would turn out better material. It was all-important to eliminate impurities. He had told them (Americans) that their sole desire was to produce metal in such a condition and temperature that they could roll it quickly into a finished form and sell it to somebody. If they wanted the resisting metal, they must study quality rather than quantity. With regard to the ingredients enumerated, such as arsenic, there was not enough to be truthfully regarded as more than a trace.

Results of the Pure Food Act.

As to tin plate, the speaker caused some amusement by describing the curious effect of the Pure Food and Drugs Act in America which had had great influence on the tinning industry. The exclusion of artificial coloring matter caused the fruits to come out as a kind of sickly white, and people did not think them so good. They were obliged to cut down the amount of tin, and the effect of that was a number of complaints that some of the tins on the grocers' shelves suddenly squirted out a stream of juice. They would have to find some way of preventing the reduction of food juices by the tin, or furnish some sort of covering; that was the problem that manufacturers were struggling with at the present time.

The speaker concluded by describing some experiments with gum shellac which had proved very effective in certain circumstances.

The president, in proposing the thanks of the members to the readers of the paper paid a high compliment to Mr. Cushman, to whom he said they were greatly indebted for presenting such a stimulating paper and opening such a discussion. Their visitor would especially appreciate the way in which they received the joke at the expense of the American tin plate maker. But probably they all enjoyed the joke better when it was directed against somebody else.

With regard to the anxiety for large outputs, he was afraid they were all apt to regard them from the balance sheet point of view. He was especially grateful to Mr. Cushman for those interesting side comments on the subject of waste. That subject was very prominently before the world at the present time. Though he looked forward to his childrn and even his great grandchildren being able to subsist, the whole question of waste was of vast importance, not only to their remote successors but to the present generation.

If the waste could be reduced only about 10 per cent, the evils against which many were clamoring and for which their statesmen were rather blindly seeking remedies, would disappear. If that sermon were preached not only from the pulpit but from the platform there would be fewer interferences with manufacturing processes, producing those unexpected results to which Mr. Cushman had humorously referred. The preservation of iron and steel was of immense importance to the world, because half the buildings in the United States and a large proportion in Great Britain depended upon iron, and they were being built in perfect ignorance as to what might take place in the future.

Dr. Walker's observation deserved the earnest consideration of every building engineer. He doubted whether precautions were being taken, and probably before long disasters of the most serious character might occur in connection with some of those structures. They were deeply grateful to the Americans for bringing that subject so prominently before the institute. He hoped that the discussion would be continued by papers in the journal.

On the invitation of the president, thanks were tendered to the readers of the paper by hearty acclamation.

The next paper by E. Heyn and O. Bauer on "The Influence of the Treatment on the Solubility of Steel in Sulphuric Acid" was taken as read, and a short discussion followed in which J. P. Stromeyer, of Manchester, J. E. Stead and others took part. Mr. Stead's observations were to the effect that the development of annodes had a direct connection with the heating of metal to 400 degrees centigrade, and the crushing of steel made the metal at the crushed points especially liable to corrosion. The importance of a particular temperature of 400 degrees was quite a new discovery which was well worthy of note. After some observations by Mr. Rosenheim, of London, and E. H. Saniter, of Rotherham, thanks were recorded for the readers of the papers.

The last paper dealt with was by W. H. Hatfield, of Sheffield, on the "Chemical Physics Involved in the Decarburization of Iron Carbon Alloys." The paper controverted particularly the theory originating with Dr. Wust, of Germany, and in the subsequent discussion, J. E. Stead, of Middlesboro, and Prof. Turner, of Birmingham, expressed their general agreement with the author of the paper.

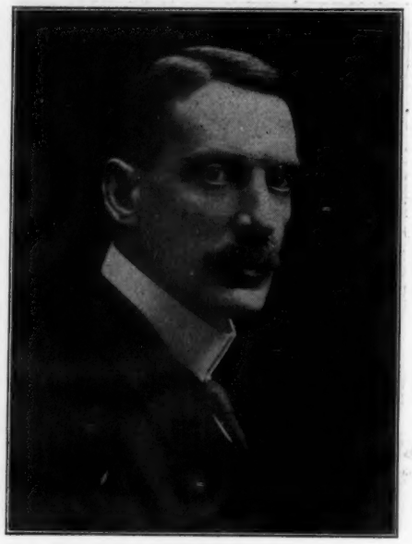
Compliments were also conveyed by Mr. Adamson, of Sheffield, and Prof. McWilliam. A pleasant human touch, which caused a general chuckle, was imparted to the discussion by H. S. Morwood, who mentioned that the paper really originated with Mrs. Hatfield, who raised the question whether English investigators were not as good as those of Germany, and that remark fired her husband to prepare a paper with the object of demonstrating the British view as against the novel theory enunciated from Germany.

Mr. Hatfield in his reply entirely endorsed Mr. Morwood's statement. Referring to a remark by Prof. Turner, he said it was quite true that sulphur to a large extent diminished during the process of annealing of malleable iron.

The meeting then adjourned until Friday.

Bessemer Medal Conferred.

At Friday's meeting the session was opened by the bestowal of the Bessemer medal upon Alexandra Pourcel by the president, Sir Hugh Bell. In making the presentation, Sir Hugh said that this pleasant duty did something to reconcile him to the continuance of the presidency. It was a special pleasure to hand that distinction to his old friend, Mr. Pourcel. To know him was to esteem him, and no one would fail to entertain the deepest respect and affection for the man. Mr. Pourcel had thoroughly deserved the highest honor in connection with his great achievements for the industry. He had been steadily at work since 1849 in noble, careful, and industrial labor and had behind him a long record of achievements. In honoring him the Institute honored itself. The president concluded by reading a lengthy record of Mr. Pourcel's achievements, which is to appear in the *Journal* of the Institute. It was recorded that Mr. Pourcel was born at Marseilles in 1841 and was instrumental in introducing the Bessemer process in France in 1867, and the open-hearth steel process in 1868. He was, however, chiefly celebrated for his investigation in the metallurgy of ferro-manganese, which he was the first to manufacture in the blast furnace. He is consulting engineer to various large iron and steel works in France and Italy, and honorary member of the Comite des Forges, and has been the recipient of numerous gold medals for valuable services rendered.



G. C. Lloyd,
Secretary Iron and Steel Institute.
(Photo by Heisted)

Mr. Pourcel, who, despite his advanced years, and his white hair, is well set up and hale looking, responded eloquently in French. He said he counted it a great honor to rank among the famous men whose labor had secured the wonderful progress in metallurgy of the last half century. The revered name of Sir Isaac Lothian Bell stood at the head of that illustrious company, and his name was worthily borne by his son, the president of the Institute. He was glad to pay his modest tribute to that remarkable departed genius whose work still remained a living authority on metallurgy. The Bessemer medal was the highest distinction attainable, and, for a long time, his ambition had been to deserve it, although the prospect seemed remote. The greatest share of any merit was due to Euverte and Valton, who were his chief friends and instructors, and who had now retired. He thanked the meeting for their great honor which crowned his industrial career, and for the kind personal reception.

A number of particulars were given regarding the achievements of the four Carnegie scholarship recipients, viz., Jahann Puppe, Felix Robin, Thomas Swinden and Thomas Baker.

The Electric Furnace.

The president was obliged to leave at this stage, and his place in the chair was taken by Windsor Richards, a past president. An abstract was read by the secretary of W. Rodenhauser, from his paper on "The Electric Furnace and Electrical Process of Steel Making," the discussion of which absorbed the bulk of the session.

Arthur W. Richards, Grangetown, remarked that electrical steel for special purposes, such as high class steel and alloy steel, had come to stay; but its general adoption would depend upon its ability to compete in the matter of cost with Bessemer and open-hearth steel. The cost was still high, and he would point out that steel of

equally good analysis was being produced by the ordinary basic open-hearth process at considerably lower cost. At the same time, he did not see the necessity of going below 0.023 of phosphorus and 0.004 of sulphur at which the author had discontinued his experiments, but it was important to know whether the experiments had not been carried further because they could not attain such a high temperature in the induction furnace as in the arc furnace. The high quality of steel produced in the electric furnace was due to the fact that the gases, such as nitrogen and oxygen, were absent.

J. M. Gledhill (Manchester) said the whole matter was really reduced to one of cost, and the important cost in these furnaces was the large amount of additional plant that was necessary. His own firm had been melting with recovery gases and had been recovering by-products, chiefly sulphate of ammonia, which reduced the cost to a very great extent. The firm at first expected to get its coal free and secure in addition one shilling profit out of the by-products, but it did not quite succeed. However, as it bought its coal for 10 shillings per ton and got 80 to 90 pounds of sulphate of ammonia from each ton, it did very well. The firm got £11 per ton for the sulphate, which reduced the fuel cost to a very low point. He believed a good deal of ground had to be got over before that method of steel making could compete with the present processes. The whole question was one of pounds, shillings and pence.

Well Satisfied.

Otto Frick (Stockholm) dealt at some length with the author's criticisms upon the Kjellin and the Frick furnaces. One of the largest furnaces in existence was in regular use at Messrs. Krupps' furnaces at Essen, Germany, and they were so well satisfied that they had taken over his German patent. The original cost of installation, since it was only a question of £1,000 in a dynamo, was quite unimportant. He contended that if they took into account the total efficiency, the electric furnace would compete very well with the Bessemer and open-hearth systems. Mr. Hiorth considered the best plan was to use the furnace as a pure induction furnace for dealing with large quantities. In refining steel, he had used 5-ton charges with 500 kilowatts.

Prof. McWilliam (Sheffield) demurred to a statement made by the author that there was no chemical action taking place in the molten steel while in the induction furnaces. That was not proved. They, in Sheffield, were supposed to be asleep, but they kept one very clear eye open. (Laughter.) The university had sent him over to examine the Kjellin furnace and they had purchased one with which they proposed to begin shortly a series of experiments, and they intended also using another crucible furnace for smelting the yellow metals. It was not altogether a question of pounds, shillings and pence, because they had to consider quality, and he knew one instance where extra money had been paid for superior material, with hope of getting it back again in the value obtained.

Prof. Turner (Birmingham) said that in his experience of dephosphorizing, the induction furnace was not so suitable, because the temperature was not so high as was sometimes wanted.

F. C. Morwood said that a resistance furnace could be handled readily by workmen and treated almost exactly on identical lines with a Siemens furnace, but what was required was that the electrical furnace should now pass out of the hands of the electrician into the hands of the steel maker. The machine was now produced, and it wanted putting into practical shape. If Mr. Richards or Mr. Saniter would lick it into shape and put it to practical use, they would produce steel which could not be produced by any existing form of furnace. Recent specifications had increased the difficulty of producing steel by ordinary methods, and if they could remove the oxides and suspended slags, they could produce the finer grades which present requirements called for.

E. Adamson (Seaton Carew) did not agree with the author that steel made in the Heroult furnace was not so homogeneous as other steel. His own practical experience told him it was perfectly so. He had himself produced 60 consecutive charges of five tons each, made in the Heroult furnace, in which the average was for phosphorus 0.006 and sulphur 0.016; that should satisfy anybody.

A. Cooper (Middlesboro) pointed out that the steel referred to was not steel made from the basic Bessemer converter, but had really gone through two distinct processes, having been purified in the electric furnace; he would like to know whether they had dealt with metal direct from the blast furnace. Until they could do so, the furnace could not be regarded as a serious competitor. It was quite easy at Middlesboro to make by the ordinary open-hearth process as good steel as was produced by the electric furnace; one of his own works had produced 20,000 to 30,000 tons of rails.

Canadian Furnace.

T. Rowlands (Niagara Falls, Can.), said he had been associated with the American Electric Furnace Co. of Niagara Falls, Can., for a considerable time, and had some experience with the induction furnace. At first they had some difficulty in the starting of the furnace. He had gotten over that trouble by making rings of pure cast iron, using washed metal for the purpose with the addition of a little ferro-silicon and had no further trouble. They melted down very satisfactorily, and if they started the furnace a number of times it was not necessary to use molten metal at all. Several steel men of America had visited the plant. They melted steel containing 1.2 per cent of carbon with a consumption of 440 kilowatts per ton, and this was done in an hour and a half. In other cases, they had used metal for rails with 560-kilowatt hours per ton. They had succeeded with 520 kilowatts for ferro-manganese. They were obliged to leave a certain portion of the charge in the furnace to start away for the next charge. He had certainly found difficulty in scooping the slag from the top of the bath. He could assure Mr. Morwood that the furnace had already got into the hands of the steel makers at a number of places in America, and was being worked on a commercial scale.

Mr. Frick, replying to some observations about Prof. Turner, assured him that the furnace would get a very high temperature and at Krupps they had worked up to 1,690 degrees Cent., and sometimes up to 1,700 degrees. That temperature was much too high for steel because they were nearing a point at which iron saturated with phosphorus.

Mr. Rodenhauser, replying to the discussion, assured Mr. Turner and others that they could get any temperature, enough in fact to melt even the walls of the furnace. In conclusion, the speaker called attention to a number of analyses which arrived too late to be printed, but would duly appear in the printed proceedings. The author of the paper was thanked by acclamation.

Prof. McWilliam read briefly the paper on "The Heat Treatment Study of Bessemer Steel," jointly prepared by himself and E. J. Barnes, of Shef-

field. W. Beardshaw, of Sheffield, said that in Sheffield they were continually studying the hardening and tempering of steel, and gave some examples of the effect of each treatment in increasing the elasticity of steel. It was, he said, a very interesting contribution, especially to the Sheffield trade.

Called Academic.

J. M. Gledhill (Manchester), while appreciating the paper, said that, being restricted merely to short bars an inch in thickness, it must be regarded as more or less academic. It would be more to the point to deal with forgings up to 50 tons. Sheffield has tried to "operate on wonder faculties" by stories of high-speed steel. His own experience showed that there was a critical point in annealing, so that if they stopped at a certain point they got the very best results. It was extremely important to raise the elastic limit and still keep the ductility.

J. E. Stead (Middlesboro) gave some instances showing the effect of rolling and pointed out that to be complete there should be alternate tests with cross sections. In his own tests, the bending tests, taken in one direction, showed double the strength of those taken in another. The speaker related an amusing example of the rejection of girders because of the appearance of certain white lines in the structure which signified the presence of manganese and were entirely normal. They were found in every steel containing 0.47 carbon, but he had great difficulty in preventing their rejection.

Prof. McWilliam replied, pointing out that though the tests might seem academic to the makers of big castings, there was an enormous amount of small material used which was exactly represented by the tests taken. The speaker concluded with humorous reference to the rivalry between Manchester and Sheffield University, and said if anybody wanted a "scrap," it was just as well to get it over. (Laughter.)

The remainder of the papers were taken as read, and on the proposition of the chairman, seconded by Mr. Ainsworth, thanks were tendered to the Institution of Civil Engineers for the use of the premises, and also to Windsor Richards, for presiding.

Carnegie Scholarship Awards.

Awards of Carnegie scholarships were made to the following gentlemen:

Johann Puppe, Dortmund, Germany, is a mechanical engineer who has made a specialty of the power requirements of rolling mills and of the mechanical effects produced in iron and steel during rolling. He was born in 1882 and was educated at the high schools of Dortmund, Bochum, Cainsdorf and Zwickau. He subsequently became rolling mill engineer at Konigin Marienhutte and at the Dudelange blast furnaces and iron works. He has also been in the service of marine engineering firms in Germany and Austria. He is awarded a scholarship of £100, the subject of the investigations upon which he is engaged being the internal effects produced during rolling.

Felix Robin, of Paris, was born in 1882 and educated at the Ecole Central des Arts et Manufactures in Paris. He has since been engaged in researches on micro-metallurgy and on the hardness of steel at the laboratory of the Conservatoire des Arts et Metiers. He is at present engaged in studying the hardness of steel and iron and the wear with these materials with abrasives and their resistance to crushing and hardness at forging temperature. He is awarded a scholarship of £100.

Thomas Swinden, of Sheffield, is a pupil of Prof. J. O. Arnold and of Dr. Carl Benedicks, of Upsala. He was born in 1886 and received his general scientific education at the University College, Sheffield. He has been recipient of numerous scholarships and of the Mappin Medal and the City and Guilds Bronze Medal for metallurgy and allied subjects. In addition to his college studies he has pursued investigations in the laboratory of Dr. Benedicks at Upsala, in Stockholm, and at several Swedish works. He is a Bachelor of Metallurgy at Sheffield. He is awarded a scholarship of £100, the subject of his research being the thermal, mechanical, electrical and magnetic properties of molybdenum steels.

Thomas Baker, of Llanelly, was born in 1877 and was educated at Wolsingham grammar school and at the Armstrong college, Newcastle-on-Tyne. He subsequently received his metallurgical training and practical experience in the laboratory of Messrs. J. Rogerson & Co., Wolsingham, after which he proceeded to the technical department of the University of Sheffield. He was awarded the Carnegie scholarship of £100 last year and is now granted a further renewal of £50, the subject of his research being the gases occluded in steel.

THE LATE BENNETT H. BROUGH.

There was an interesting sequel at the meeting of the Iron and Steel Institute in London to the death of Bennett H. Brough, the late secretary of the institute. Mr. Brough, it will be remembered, was seized with unexpected illness during the Middlesbrough meeting in the autumn and died within 48 hours after an operation for appendicitis. His widow and children were left inadequately provided for, and as the result of an appeal initiated by Sir Hugh Bell, nearly £6,000 was raised. Prior to the meeting of the institute, Sir Hugh Bell issued a circular showing the position of the fund. It was pointed out that trustees were necessary, and Sir Hugh Bell, W. H. Bleckley, and Illtyd Williams had intimated their willingness to serve. The money has already been invested in funds which as Sir Hugh has advised furnish adequate security and will yield 4 per cent per annum. A trust deed has been drawn up, which was on exhibition to those interested at the meeting of the institute, showing that the money is invested as follows: £1,000 in Rohilkind & Kimaon railway, 4 per cent debenture stock; £1,000 Burma railway Co.; £880 Rand Water Board; £1.388 Buenos Ayres & Pacific Railway, 4½ per cent Consolidated debenture stock; £1,332 Indian Railways, 3½ per cent stock. The sanction of the subscribers will be asked for these proceedings.

A Proposed Memorial.

An entirely different movement promoted by the friends and admirers of Mr. Brough is the establishment of a Brough memorial. The suggestion is that a scholarship should be established for boys at the City of London school where Mr. Brough was educated and tenable at the Royal School of Mines where both as student and teacher he did such excellent work. A committee has been formed with George T. Holloway, of 57 Chancery Lane, London, W. C., as secretary and a circular has been issued inviting subscriptions to be sent to the treasurer, R. E. Commans, Speer Road, Thames Ditton, Surrey.

Batcheller, Clark & Batcheller, dealers in machinery and supplies at 90 West street, have assigned for the benefit of creditors to Horace D. Byrnes, of 309 Broadway. The officers of the company are Herbert A. Kling, president; May V. Kling, secretary. The company was incorporated in 1908 with a capital stock of $20,000.

AMERICAN FOUNDRYMEN'S ASSOCIATION CONVENTION.

(Continued from page 972)

ployed, was eagerly sought for. One of the features of their system of sand conveying brought out by Mr. Sleeth during his questioning was that the flasks and sand shaken out of a mold are back again and being used within 20 minutes. Another person asked if it would be economical to install the Westinghouse system of continuous melting in a plant melting about 20 tons a day, to which Mr. Sleeth replied that at least 50 tons a day should be required.

The Brass Section took charge of the meeting after Mr. Sleeth was through. The first paper was entitled "General Principles of Operation of Industrial Pyrometers," by C. H. Wilson. The main feature of this was that the application of a thermo electric pyrometer for the determination of the temperature of brass prior to pouring so far is only partially successful.

"Notes on Brass Melting," by Charles T. Bragg, was read by title. Members, however, were invited to send in their discussion which would be printed in the transactions of the meeting.

The "Melting of Brass Turnings in the Oil Furnace," by Edward H. McVeen, of the F. W. Wakefield Brass Co., was next taken up. The discussion on this centered around the consumption of oil and air pressure in the various furnaces on the market.

Two or three members corroborated Mr. McVeen in his statement of the improved castings resulting from using remelted metal, one gentleman stating that he always followed this practice on government and high pressure work.

After the election of officers the Brass Section closed its discussions by passing a vote of thanks and sympathy to the retiring president, Charles J. Caley, who was unable to be present, owing to sickness.

Thursday Morning Session.

The paper entitled "Electrolytic Assay of Copper," by George L. Heath, had not been printed, and as the author was not present it was read by title. It will appear in the transactions.

The next paper was the "Tensile Strength of Zinc-Aluminum Alloys," by W. D. Bancroft.

The paper entitled "System of Distributing Waste Losses in Raw Materials to the Cost of the Finished Product," was summarized by its author, D. W. Olsen. No discussion followed.

Edgar A. Custer Jr., of the Tacony Iron Co., Philadelphia, followed with his paper on "The Permanent Mold." This was illustrated by lantern slides showing the production of castings in the permanent mold in all its details.

The paper on "Continuous Melting," prepared by Richard H. Probert, Louisville, Ky., was read by title, owing to lack of time.

The session on Friday morning was devoted entirely to the election of officers and other business matters, including action on the report of the committee appointed to prepare standard specifications for foundry iron.

The Exhibits.

Music hall, Cincinnati, was converted into a model foundry during "Founders' Week," May 17 to 22. The exhibits, more numerous and elaborate than heretofore, occupied the entire main floor and furnaces, ladle heaters, mold dryers, core ovens, etc., were housed in an adjoining building especially built for this occasion. One of the noteworthy features of the show was the molding machine display. It included all types for various classes of foundry work, both large and small, and the progress in mechanical molding during the past year, exemplified by the numerous new types shown, proved a revelation to the visiting foundrymen. Demonstrations were made daily and the molds produced varied in weight from a few pounds to five tons. The spectacular operation of the large machines attracted considerable attention, and from experiments already made it is evident that molds weighing up to 25 or 30 tons can be successfully molded by machine. To complete the sequence of operations of the large jolt ramming molding machines, an overhead, pattern-drawing, roll-over device was displayed, which can also be successfully used on large floor work. Many of the machines exhibited were especially adapted for jobbing work, and the shop producing miscellaneous castings can equip for mechanical molding as readily as the specialty foundry.

All kinds of cleaning machinery were also displayed, including tumbling mills, sand blasting apparatus, etc. That foundrymen generally are devoting more time to the preparation of their sand was indicated by the number of sand mills, mixers, grinders and conveyors shown. One large mill installed in the temporary building elevates the sand, mixes and tempers and delivers it onto the floor ready for use.

Every conceivable device for the core room was also on display, including core machines for stock and irregular cores, core coning and cutting-off machines, core sand mixers, core racks and stationary and portable core ovens. Suitable space was also devoted to woodworking machines for the pattern shop, and a mechanical woodworker, intended to effect great economies in the production of patterns and core boxes, was shown in operation. Several Cincinnati machine tool builders who made displays were so favorably impressed with the exposition that they have decided to reserve considerable space next year for operating exhibits, and the indications are that equipment for machine shop, as well as the foundry, will represent no small part of the 1910 show. The temporary building resembled a model brass foundry, inasmuch as it contained the displays of various types of brass melting furnaces and practical demonstrations were made daily to show their method of operation. Ladle heaters, mold dryers, foundry torches and other equipment were also shown in this annex.

ACTIVITY AT IRON MINES.

Republic, Mich., May 22.—The iron ore trade of Michigan is improving and furnaces are again entering the market. Sales aggregating several millions of tons have been made the past fortnight for delivery this year. While because of the depressed state of the iron and steel business last winter, predictions were made that this season the mines would be compelled to accept lower prices for their product, yet the operating concerns, however, have stood firmly together in maintaining quotations. All transactions to date have been on the basis of last year's prices, which apparently are satisfactory to the consuming interests. No attempt seems to have been made to get concessions. Shipments are somewhat hampered because of the lake marine strike and there is some apprehension lest various operators may be unable to make deliveries as promptly as they desire. This is especially the case with operators whose stock pile space already is filled to capacity. The freighters in commission are steadily increasing and there is no fear at all that all the ore needed will not be forwarded before the close of navigation. By June 1 deliveries at lower lake ports will foot up over 2,000,000 tons.

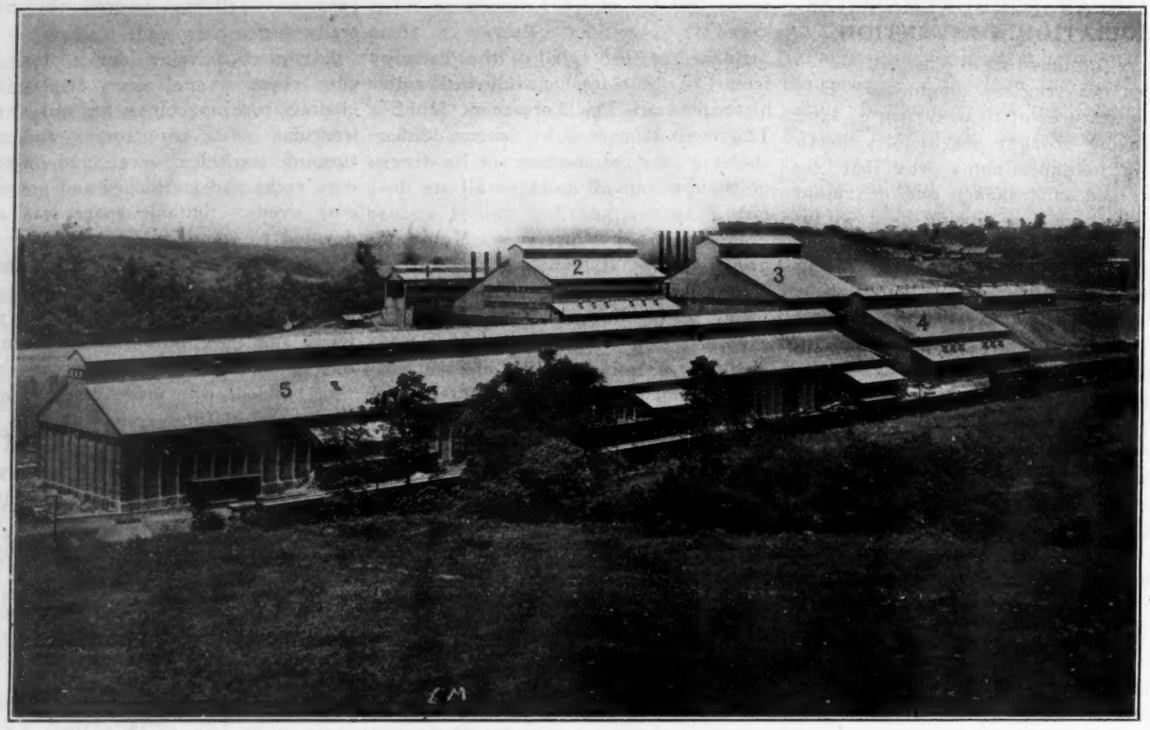


FIG. 1—PLANT OF UNIVERSAL PORTLAND CEMENT CO., AT UNIVERSAL, PA.
(1) Raw Material Trestle. (2) Dryer and Raw Material Building. (3) Burner Building. (4) Finishing Mill. (5) Stock House.

THE MANUFACTURE OF PORTLAND CEMENT[1]

Cement as a By-Product of the Blast Furnace—Description of One of the Plants of the Universal Portland Cement Co.

BY WM. M. KINNEY.[2]

Using the definition of the Standard Specifications, Portland cement is the finely pulverized product obtained by grinding the clinker resulting from the calcination to incipient fusion of an intimate mixture of properly proportioned argillaceous and calcareous materials, to which no addition greater than 3 per cent has been made subsequent to calcination.

As we are dealing with Portland cement in which slag is a constituent it might be well to define puzzolan cement (so-called slag cement). The definition given in professional papers, No. 28, of the corps of engineers, United States army, under the heading of "Slag Cement," is as follows: "This term is applied to cement made by intimately mixing by grinding together granulated blast furnace slag of a certain quality and slacked lime, *without calcination* subsequent to the mixing."

From the definition for Portland cement it can be seen that raw material for cement is not limited to one particular form of rock, but may be made from any materials furnishing the desired elements. It is not strange, therefore, that we find Portland cement manufactured in this country from a number of raw materials, which,

FIG. 2—GRANULATING SLAG.

[1]Abstract of a paper presented at the meeting of the Engineers' Society of Western Pennsylvania, Feb. 16, 1909, and published in the March proceedings, page 103.

[2]Assistant Inspecting Engineer, Universal Portland Cement Co.

with a few exceptions, may be classed under four heads:

Argillaceous limestone (cement rock) and pure limestone, one degree.

Clay or shale and limestone two degrees.

Clay or shale and marl, three degrees.

Granulated slag and limestone, four degrees.

Portland cement may also be divided into classes according to the method of manufacture.

a—Wet process.

b—Semi-wet process.

c—Dry process.

In the wet process (principally for plants using marl), the raw materials are ground and fed to rotary kilns in the form of a slurry containing sufficient water to make it of a fluid consistency. In the semi-wet process a similar, but dryer slurry, is formed into bricks and burned in dome kilns, while in the dry process, most generally used, the raw materials are ground, mixed and burnt in the dry state.

It is about the various mechanical devices employed in Portland cement manufacture that I wish particularly to speak, and to make the subject more intelligible have decided to deal exclusively with the methods used in our plants near Chicago and Pittsburg. A photograph of our No. 5 plant at Universal, Pa. (see Fig. 1), shows the general layout of a cement plant. This plant now has a capacity of 4,500 barrels a day, which is being increased to 10,000 barrels per day.

A description of our methods will serve to illustrate general practice in modern Portland cement manufacture, for though we are the only company in the United States utilizing blast furnace slag and limestone for the manufacture of Portland cement, yet with practically no change the same plants could manufacture Portland cement from any of the raw material used.

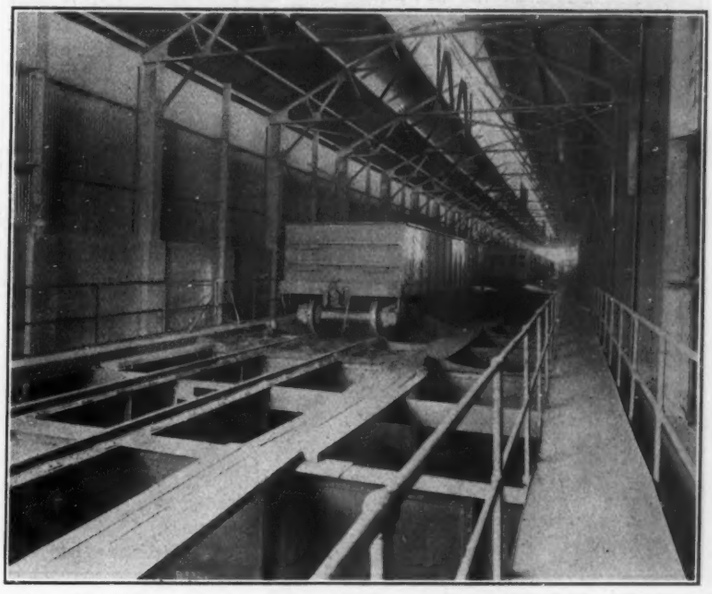


FIG. 4—RAW MATERIAL TRESTLE, NO. 4 PLANT, UNIVERSAL PORTLAND CEMENT CO., BUFFINGTON, IND.

In the manufacture of Portland cement from granulated slag and limestone the slag furnishes the silica, alumina and part of the lime. To obtain the remainder of the calcium required, limestone is added. To avoid the necessity for frequent changes in the proportions of the raw materials and to secure a uniform product only slag having a uniform chemical composition from day to day is used. This also is true of the limestone; but a necessary feature is the use of limestone very low in magnesia, both as a flux in the blast furnaces furnishing slag and as a raw material to be used with the slag in producing cement. Considering these necessary qualifications the most available furnaces are selected and equipped with apparatus for the granulation of slag. This granulation is done by means of a stream of water under 15 to 18 pounds pressure, directed against the molten slag as it flows into the pits. One method of performing this operation is shown in Fig. 2. Here in the background will be noticed the slag flowing from the furnaces down the trough to the "slag gun" located at the end of the pit. A spray of water emerging from the dividing wall between the two sections of the pit hits the stream of molten slag as it comes from the gun and granulates it. By another method of granulation. (see Fig. 3) used alternately with this one molten slag flows down the trough in the middle of the dividing wall between the two halves of the pit. From this main trough it may be diverted into either half, and is granulated by a stream of water flowing from under the outlet. This granulation greatly simplifies the handling and grinding of the slag.

As shown in Fig. 6, the granulated slag is transferred in a clam-shell bucket to hopper bottomed cars on adjacent tracks. The limestone also

FIG. 3—LOADING CARS WITH SLAG.

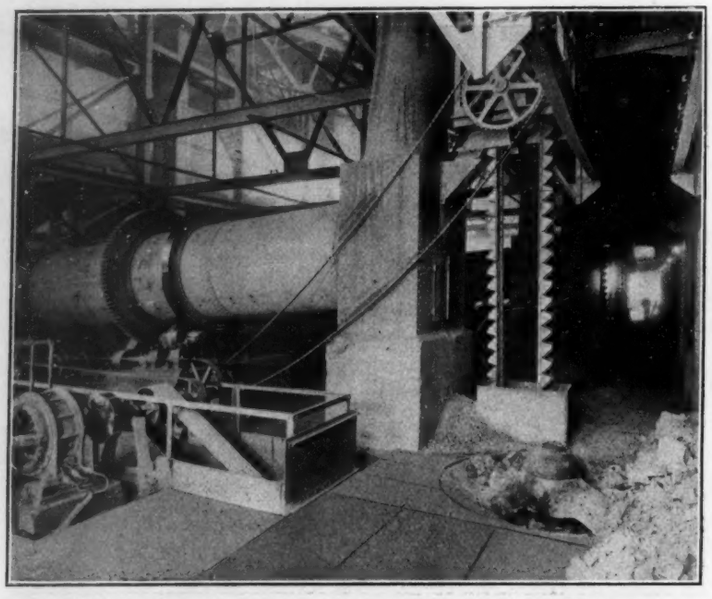


FIG. 5—LIMESTONE DRYER, SHOWING CRUSHER AND ELEVATOR.

being loaded in hopper bottomed cars, the handling of these materials at the cement plant is a simple matter. As received they are switched in on the raw material trestle illustrated in Fig. 4. This trestle at our No. 4 plant will accommodate ten cars under the shed and the bins below will hold 1,450 tons of coal, 1,670 tons of slag and 6,130 tons of limestone. Not being hopper bottomed these bins have a large supply of raw material in reserve which can be shoveled in case of necessity.

Like flux stones, the limestone is the run of the quarry, ranging in size from about 12 inches in the largest dimension down to dust. From the raw material bins it is fed into the gyratory crushers shown in the foreground of Fig. 5. Here the crushers reduce the stone to sizes ranging from 1½ inches down and discharge direct into the bucket elevators, which raise it to the feed spouts of the rotary dryers. These dryers, of which the stack end is shown in the illustration, are from 30 to 50 feet in length, according to the type, and about 5½ feet diameter. They are constructed of steel and lined with fire brick or cast iron.

The rotation of the dryer gradually feeds the stone toward a flame, which enters at the opposite end. Fig. 6 shows the forward end of a dryer fitted with stoker and forced draft. This furnace uses coal which is crushed in an adjacent building by Williams crushers. The 16-inch air duct in the foreground furnishes the air blast for the furnace, which is maintained at a heat only sufficient to drive off the moisture as it is not the intention to drive off any of the carbon dioxide in this operation.

Another form of dryer uses pulverized coal in a similar type of burner to that utilized for kilns. In this scheme the coal is either pulverized in a separate building, transferred and blown into the kiln, or is pulverized and blown in by an Aero pulverizer placed in front of the dryer.

Similar dryers are used for the slag and no preliminary crushing being necessary the slag is elevated to the dryer feed spouts direct from the bins. A clam-shell bucket operated by a crane assists in the handling of the slag.

Two heavy steel-tired rings riveted to the shell of the dryer (see Fig. 5), about one-quarter the length of the drum from each end rest on cast iron rolls which act as supports for the heavy dryers. The end thrust is taken by horizontal rolls set against the side

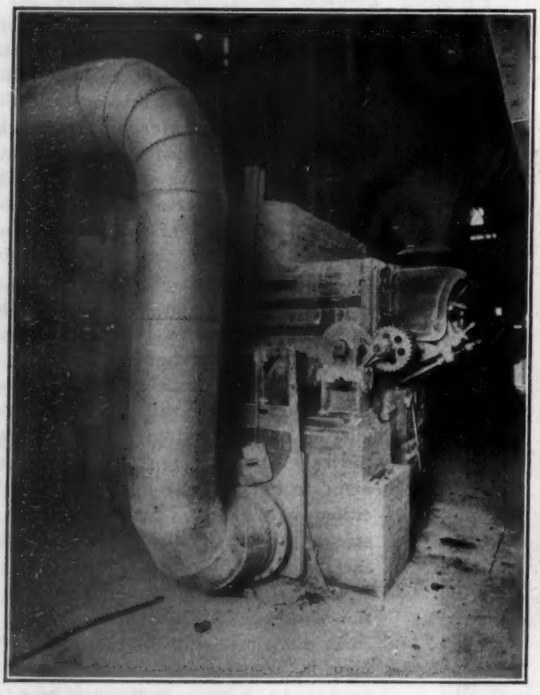


FIG. 6—STOKER FOR DRYERS.

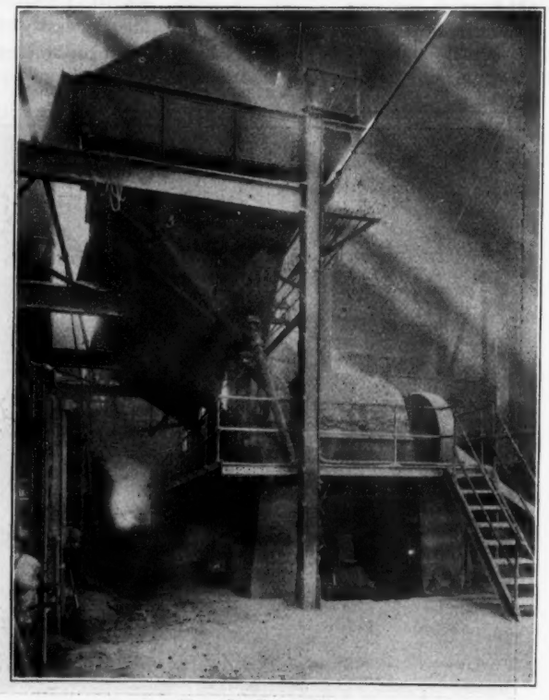


FIG. 7—BALL MILLS.

of these rings and motion is transmitted to the dryers through a large gear secured to the shell just forward of the rear ring. Each stone set, including dryer, crusher and elevator, is driven by a 40-horsepower motor, while the slag sets, consisting of only dryer and elevator, require but 10 horsepower.

The "Squirrel Cage" type of induction motor is used for driving the dryers, and in fact, is used quite generally throughout the mills. In manufacturing cement few variable speed motors are required, and considering this the induction motor without brushes is especially adaptable, for a motor with brushes would be at a disadvantage in the dust.

Leaving the dryers at the forward end, each of the raw materials is elevated to the storage bins shown in the foreground of Fig. 7. From these hoppers it is fed into the ball mills in which the preliminary grinding is done. This is accomplished by the rolling and impact of forged chrome steel balls (varying in diameter from 3 to 5 inches) on perforated white iron grillage plates. Secured to the same frame and arranged in cylindrical form surrounding the grillage plates are screens through which the fine material must pass before leaving the mill. A light steel shell enclosing this drum acts as a collector for the dust and forms the down spout for the ground material.

These ball mills (Fig. 7) require as an initial load 4,200 pounds of steel balls which, to maintain uniform load, must be replenished at the rate of 40 or 50 pounds per week. The arrangement of the grillage plates is such that these balls are being raised and dropped continuously. A 40-horsepower motor driving the ball mill through a set of gears maintains its speed at about 20 revolutions per minute.

The fine material passing the ball mill screens is conveyed on belt conveyors running under the ball mills to the elevators at the center of the building, where it is raised to the slag and limestone hoppers, above the weighing machines. The material from these hoppers is drawn off by means of screw conveyors which, being driven through an electrical clutch, are automatically stopped when the scale hopper has received the proper weight of material. To secure accurate cut-off the spouts leading from the hoppers to the scales are equipped with shut-off gates which are operated by two small solenoids. A large solenoid operates the release gates which permit the weighed quantities of slag and limestone to empty into the mixing hopper below the platform. The operation of these solenoids and the electrical clutches is governed by the movement of the balance arms enclosed in a glass case on the weighing platform. Each plant is equipped with two such measuring devices, either one of which can take care of all material passing through the mill.

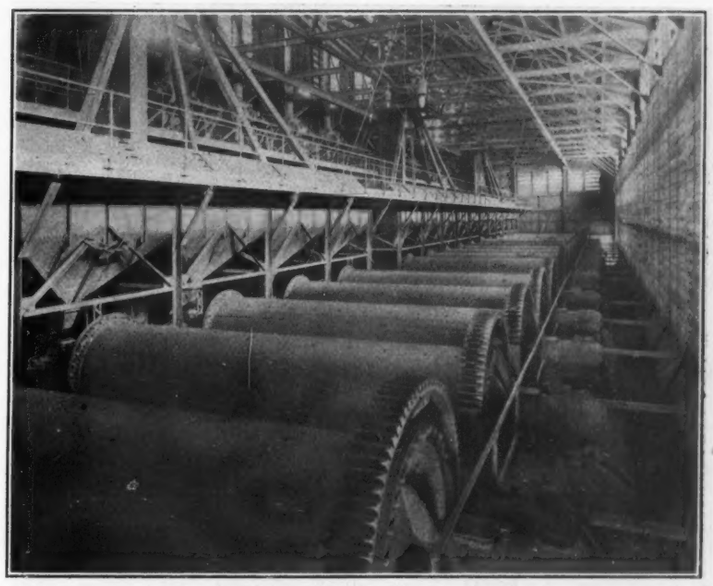


FIG. 8—TUBE MILLS (RAW MATERIAL).

From the mixing hopper below the scale platform the raw material is conveyed by means of a screw conveyor to the elevator shown in the view of the tube mills (see Fig. 8). The long pipes leading at various angles from the elevators distribute the mixture to the individual tube mill hoppers, from which it is fed into the tube mills. It is in these mills that the final mixing and grinding of the raw material is done.

The tube mills consist of a steel plate drum, with cast iron ends, about 22 feet long and 5 feet in diameter. Bolted to the inside of the shell is a white iron lining cast in sections. The tube is partially filled with flint pebbles imported from Denmark or some other northern European country. These pebbles range in size from 1½ to 3½ inches, are extremely hard and will stand a great deal of wear. By their abrasion, one on another, the

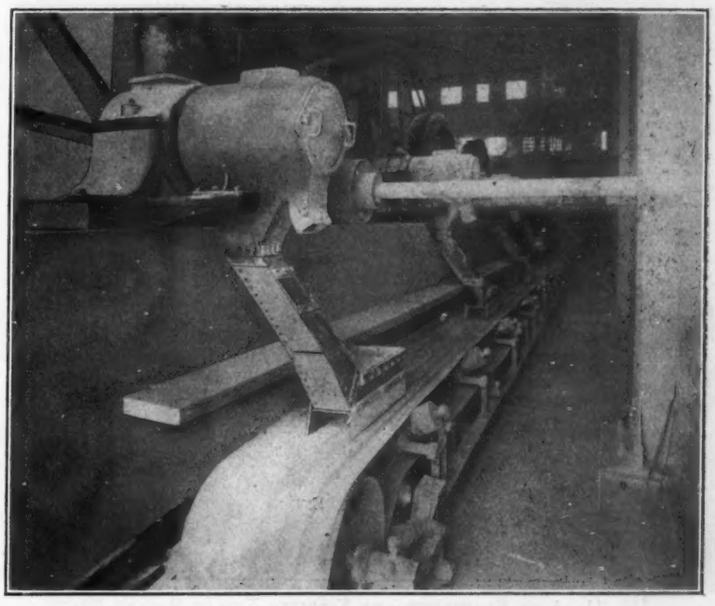


FIG. 9—TUBE MILL DISCHARGE AND CONVEYOR BELT.

FIG. 10—ROTARY KILNS AT PLANT NO. 3, UNIVERSAL PORTLAND CEMENT CO., BUFFINGTON, IND.

raw mixture already finely ground is still further pulverized.

As shown in this view, and more clearly in Fig. 9, all the tube mills deposit on the same belt so that again we have a thorough mixing of the raw materials. This is a point which I wish to particularly emphasize as illustrating the many precautions that are taken in a modern mill to obtain uniform quality.

The layout of our plants permits placing the motors for driving the tube mills in a building separate from the one housing the mills. Power is transmitted through a flexible coupling to a small pinion which drives the large gear wheel on the discharge end of the mill.

Leaving the belt, the raw material is ready for calcination and is elevated and conveyed to hoppers above the rotary kilns. These hoppers are shown on the left side above the kilns in Fig. 10. A screw conveyor feed empties the material into a water cooled spout projecting through the brick housing at the stack end of the kilns into the rotating drum.

The rotary kilns used in burning Portland cement (see Fig. 10), consist essentially of a brick lined steel shell supported at two or more points on heavy rolls. It is enclosed at the rear end by a brick housing through which the waste gases of combustion escape to the stack. At the forward end is a movable steel and fire brick housing such as is shown in Fig. 11 This housing can be rolled back when it is necessary to repair the lining of the kiln.

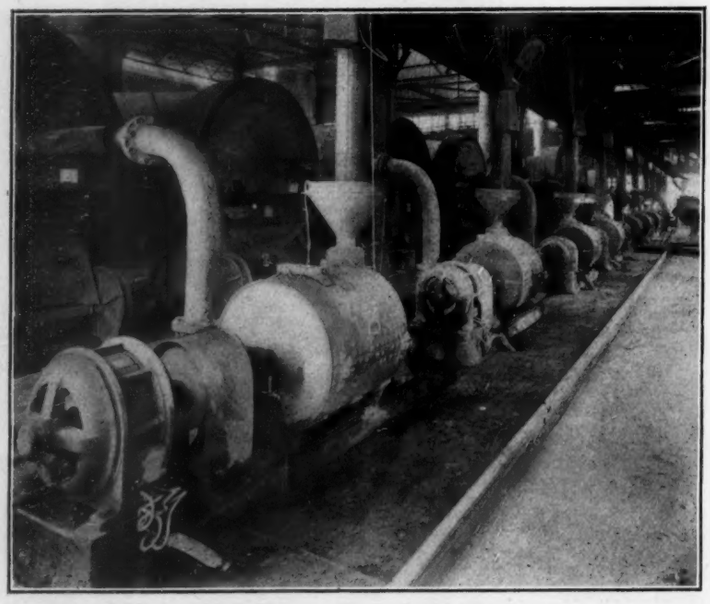


FIG. 11—AERO PULVERIZER AND FORWARD END OF ROTARY KILNS.

The steel tires shown in Fig. 10 bear on 24-inch rolls, of which there are four for each tire. Riveted to the steel shell and just forward of the rear tire is the driving gear. On the concrete foundation, with the bearing rolls, is placed the driving mechanism for the kiln. The kilns operating in our plant range in size from 60 feet long by 6 feet diameter in the first plant constructed to 120 feet long by 7 feet 6 inches in diameter in the two started in 1907. A variable speed induction motor drives the larger kilns, which are maintained at a speed of about one revolution per minute. The pitch of the kiln with its revolving motion keeps the material flowing steadily toward the flame.

To protect the steel shell of the kilns from the intense heat (close to 3,000 degrees Fahr.), a fire brick lining is used, varying in thickness from 9 inches at the firing end to 4 inches at the stack end. Powdered coal is used for burning the raw material. It is blown through a light steel pipe entering the center of the front housing of the kiln. We have two methods in use for performing this operation; one in which the coal is pulverized in a separate building in Fuller-Lehigh pulverizers, while in the other the coal is only crushed before being conveyed to the burner building. The crushed coal is fed from the hoppers above the kilns into Aero pulverizers which powder it and at the same time furnish the blast for the flame. These machines (see Fig. 11) being motor driven, take up but little room in front of the kilns. In the background of this photograph can be seen an auxiliary pulverizer which may be connected with any of the coal hoppers and kiln feeds, thus avoiding the necessity of shutting down a kiln in case repairs to a pulverizer are necessary. When the coal is pulverized in a separate building a screw conveyor feeds the fine coal into the feed pipe and an air blast furnished by a centrifugal blower carries the coal into the kiln.

After passing through the kiln the material is in the form of "clinker" ranging in size from about ½ inch up to 3 inches. Leaving the kilns at the forward end, the clinker is discharged into a conveyor or elevator, which in

turn discharges it into the clinker storage. Fig. 12 shows the clinker pile at our No. 3 plant. Here the clinker is allowed to remain until it is required for grinding into cement, a two weeks' run being usually carried in storage. The cranes, of which there are two for each pit, have a span of 80 feet and a bucket capacity of 3 cubic yards. They are used to convey the clinker to the clinker hoppers in the finishing mill.

These hoppers are located just beyond the concrete wall shown in the right of Fig. 12, and feed direct into the small crushers shown in Fig. 13. These are simple jaw crusners with removable high carbon steel jaws reducing the clinker to about ¼ inch and under. They discharge into Maxecon mills below, which perform the preliminary grinding. A Maxecon mill consists essentially of three chilled iron rolls about 15 inches diameter set with their axes in a horizontal position. The rolls bear on the inner surface of a revolving ring, contact being maintained by means of heavy yokes and springs.

The material fed to the mills falls on the inner concave surface of the ring. The upper roll is driven and sets the ring in motion at such a speed that sufficient centrifugal force is developed to maintain the material on the inner face of the ring in a layer about an inch deep, so that as the ring revolves the material is carried with it and passes under the rolls successively until it is crushed down and squeezed over the edges of the ring, whereupon it falls to the discharge.

The feed for the Maxecon mills comes from two sources; one (the main feed), direct from the jaw crushers, while the other is a return from the Newaygo separators shown in the background of Fig. 13. In these separators the fine discharge from the Maxecon mills is passed over two screens placed one above the other. These screens reject the coarser particles and return them to the mills for regrinding. A feature of these separators is the method of keeping the screen from clogging. The small shafts above the casing carry small steel hammers, which, as the shafts revolve, knock pins which vibrate the screens. The greater bulk of the raw material passes out through the screw conveyor at the bottom of the separator and is fed to the gypsum adding devices. These machines are so adjusted that to a given weight of clinker there is automatically added a known weight of gypsum. As

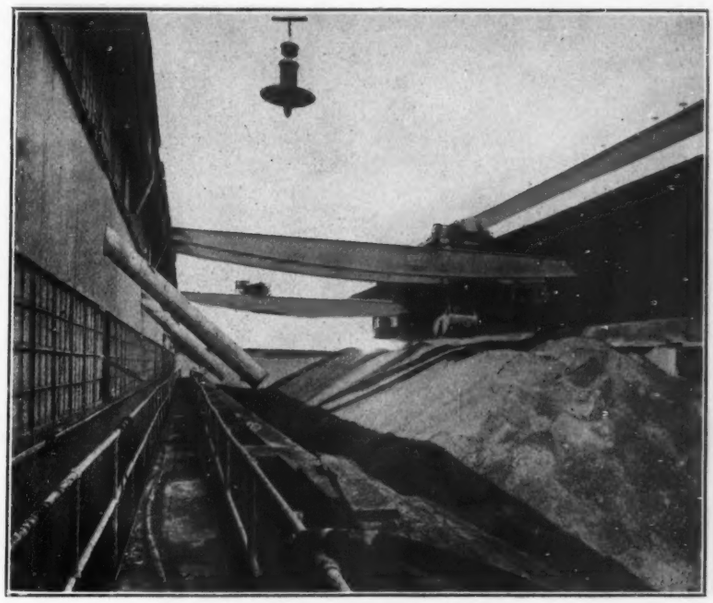


FIG. 12—CLINKER STORAGE.

the amount of sulphuric anhydride (obtained from the gypsum) is limited to 1.75 per cent by the Standard Specifications and 2 per cent by the U. S. Army Specifications, the necessity for such an accurate proportioning device can be appreciated.

Following the addition of the gypsum the material passes to the tube mills (see Fig. 14), where the final

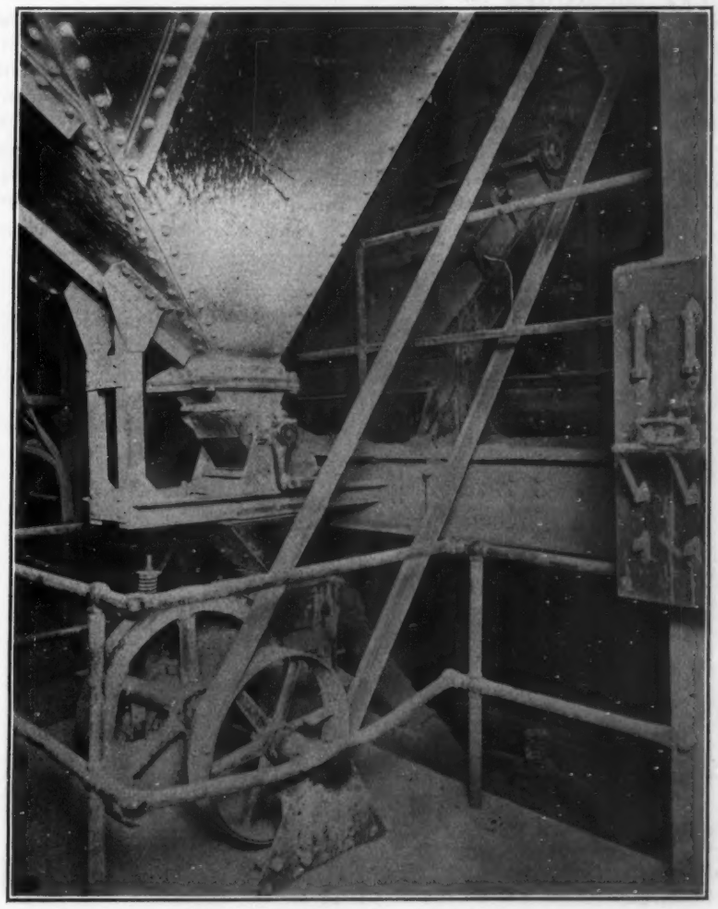


FIG. 13—CLINKER CRUSHER, MAXECON MILL AND NEWAYGO SEPARATORS.

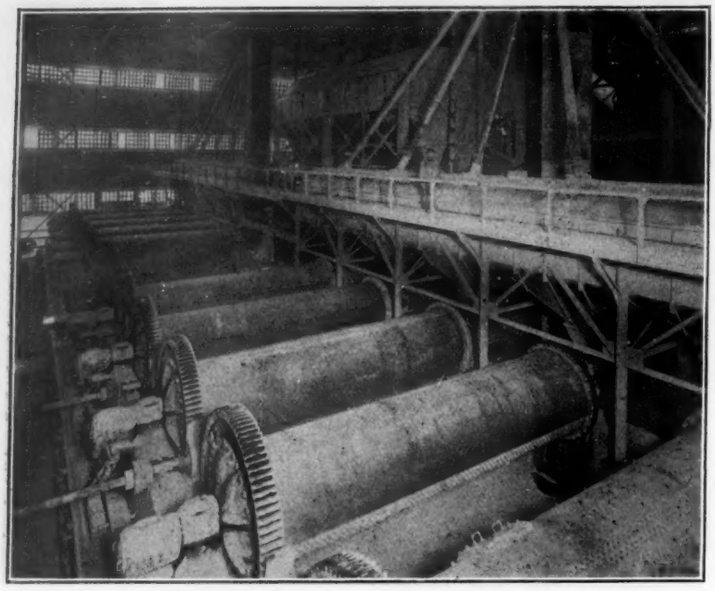


FIG. 14—TUBE MILLS (FINISHED MATERIAL).

grinding of the cement is done. These tube mills are similar to the raw material finishing mills and in them, as in the case of the slag and limestone mixture, a most thorough combination of the cement and gypsum is obtained. A single belt receiving the material from all the mills transfers it to a belt running up an incline to the stock house. This belt, shown with the tripper in Fig. 15, is about one-third of a mile long and extends the full length of the stock house. The tripper shown can be moved the full length of the belt and deposits cement into any of the storage bins.

Both the ground slag and limestone leaving the belts under the ball mills, the raw mixture, just before being elevated to the burner building and the finished cement as it enters the stock house is sampled for chemical and physical analysis by the simple sampling device shown in Fig. 16. This sampler consists of a spiral bent pipe mounted on a shaft which is driven by a belt from the conveyor roll shaft. The opening at the sampling end of this pipe is reduced so that as the shaft revolves a small quantity of the material on the belt is picked up and carried around in the tube to the discharge end from which it empties into a small box at the side of the belt. At regular periods the samples thus obtained are taken to the laboratories for test and analysis.

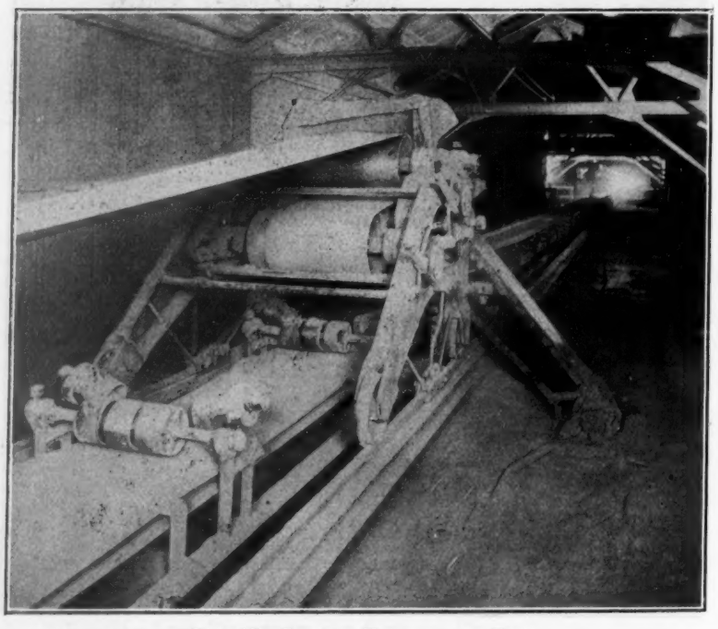


FIG. 15—CEMENT TRIPPER AND BELT.

The advantage of a continuous sampler of this type over the common method of taking a snatch sample from the belt can be greatly appreciated, for it gives an average sample of all the material going over the belt rather than of that on one particular section of the belt.

The demand for cement in summer time greatly exceeds the daily capacity of the mill, while during the winter and early spring it falls below that amount. To permit continuous operation of the mill as well as to insure properly seasoned cement it is therefore necessary to have a large storage capacity. Fig. 1 shows a typical stock house for a modern cement plant. This stock house, including a room at one end for the storage and repair of returned sacks, covers an area of 100 by 700 feet. Three packing rooms extending the full width of this building furnish unexcelled facilities for making prompt shipments during the rush season. The bins, of which there are 16, ranging in size from 6,000 to 120,000 barrels capacity, will hold approximately 500,000 barrels of cement. The stock house is constructed entirely of steel and reinforced concrete so that absolute dryness in the bins is assured.

Slightly above the floor level of the bins are the tops of the tunnels in which is located the conveying machinery for removing the cement from the bins. The cement is drawn off through 11 inch by 18 inch openings in the tops of these tunnels and passes through cast iron spouts shown in Fig. 17 to the screw conveyor below. Opening the slides in these spouts permits the cement to enter the conveyor by which it is transferred to the cross-conveyor under the packing room floor. (See Fig. 18.) This cross-conveyor carries the cement to an elevator which raises it to the hoppers above the packers.

Most of the packing in our plants is done by manual labor, as up to the present time no automatic packing machine has entirely eliminated the difficulties met with in handling such material. Several types of automatic packing machines have been tried and other types are to be tried soon, but the tendency of cement to pack in the hoppers and clog up the machinery makes the successful oper-

ation of such machines a difficult problem.

During the loading of cars for shipment every tenth barrel or fortieth sack is sampled for check tests. These samples, with the samples secured at the various points in the manufacturing process are taken to the laboratories in the office building where the various chemical and physical tests are made.

Fig. 19 shows a corner in the physical testing laboratory. This laboratory is located in the basement of the office building. Occupying a similar position at the other end of the building is a similar room set aside for the use of testers connected with outside laboratories. It is in the physical testing laboratory that the tests for fineness, soundness, tensile strength, etc., are made, while above on the main floor of this building the chemical laboratory is located where the various chemical analyses of the raw and finished materials are made. Here is determined the chemical composition of the slag and limestone prior to mixing, of the raw mixture and of the finished product. Here also analysis is made of the coal and gypsum, as no materials are used until they have been accepted by the chemists.

The building in which these laboratories are located also contains the general mill offices.

Electric power is used throughout the mills. It is generated by gas engines at the Carrie furnaces and transmitted at 60 cycles and 22,000 volts over a three-phase line to the transformer station, where the voltage is reduced in 50 to 1 transformers to 440 volts, the voltage almost universally used throughout the mill. Motor generator sets are used to convert the 440 volt alternating current to 110 volts direct for lighting purposes. Motor-driven pumps furnish air for cleaning motors, pumping water and general use around the plant.

From the foregoing description of our plants it can be seen that the manufacture of Portland cement is now on such a basis that a high grade product of uniform quality is assured. The remarkable growth of the industry is not equalled by that of any other manufactured article, and particularly is this true of the Portland cement made from slag and limestone, for the output of this company has increased from less than one-half of one per cent of the total output of the United States in 1900, to more than 11 per cent in 1908.

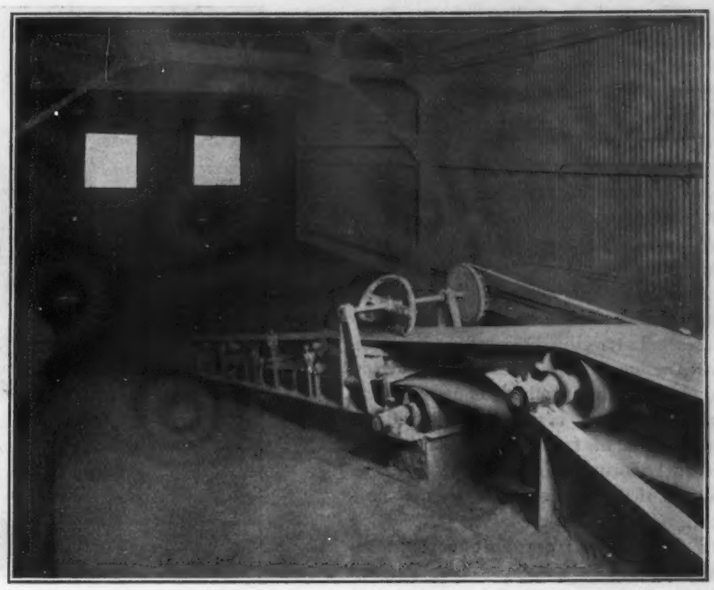


FIG. 16—SAMPLING DEVICE.

A GAS PRODUCER FOR BITUMINOUS COAL AND LIGNITES.

In a paper entitled "Recent Developments in Producer Gas Plants" read by C. B. Lamont and Nesbit Latta before the Pacific Northwest Society of Engineers at Seattle May 8, 1909, a new type of suction gas producer, designed for successful operation on bituminous and lignite coals, was described. This producer has been designed particularly for operation on the soft coals of the Pacific coast and other western states.

In introducing the subject Mr. Lamont stated that while the ordinary type of suction producer works admirably on anthracite coal, coke or charcoal it has not been successful with the softer grades of fuel. There are believed to be no successful suction producers at work and operating on native fuels in the state of Washington at the present time.

The failure of the suction producer to handle bituminous fuels successfully is due to operating conditions inherent with the design of the apparatus. These conditions result in a gas varying widely

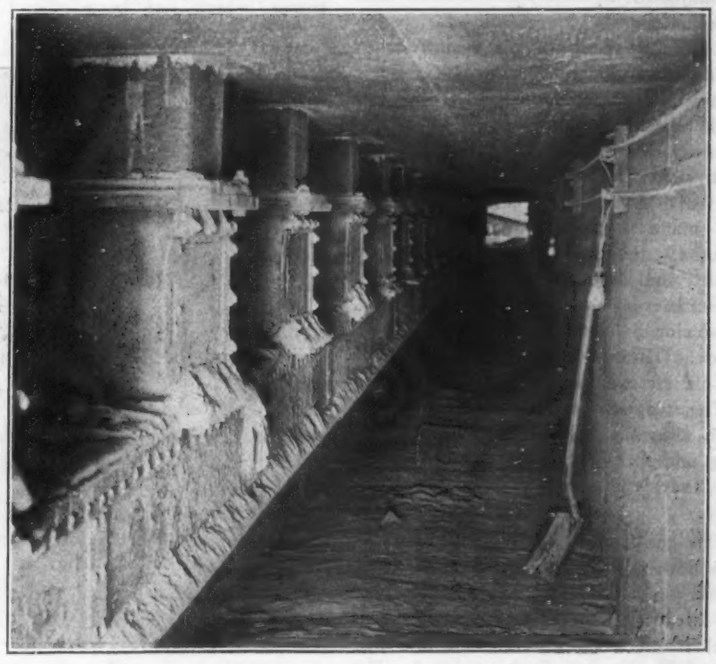


FIG. 17—TUNNEL UNDER STORAGE BIN.

in quality and in a loss of the heat contained in the coal tar which is deposited in the pipes and purifiers and treated as a waste product.

When a fresh charge of soft coal is delivered to the ordinary producer the volatile gases are immediately driven off, furnishing the engine with a rich, explosive gas. As the temperature of the fuel rises the rich, volatile gases grow less in quantity, while the quantity of carbon monoxide, a much weaker gas, increases. Later in the cycle of operations the quantity of carbon monoxide also decreases until the gas becomes so weakened that it is necessary to add a fresh charge of fuel. At the same time the fuel forms clinkers and a large amount of ashes which clog the producer. The operation of a gas engine with gas made from soft coal in an ordinary suction producer was likened by Mr. Lamont to supplying a steam engine alternately with steam from two boilers, one of which carried 150 pounds pressure and the other only 50 pounds.

Description and Operation of the Producer.

The producer which is designed to overcome these difficulties and use western lignites with success consists of an enclosed fire brick box provided with a flue and built very much like a reverberatory furnace. Into this chamber or furnace, coal, which has been previously pulverized until it will pass a 45-mesh screen, is injected with air through a special nozzle. The relative quantities of air and coal admitted can be adjusted as nicely as the air and gasoline in an automobile carburetor. At first an excess of air is introduced until the walls of the producer have attained a temperature of 2,500 or 3,000 degrees Fahrenheit. Then the quantity of air admitted is decreased and steam is turned on until a gas of the desired quality is produced. The gas made in this manner has a rich, definite composition; it is uniform in quality and quantity. The tarry residues have been volatilized and "cracked," producing a fixed gas that will not condense. The entrained coal dust in the gas is removed in a dust collector.

The temperature of the producer is such that the ashes are reduced to a slag and can be tapped out at intervals like the slag from an open hearth furnace.

The gas engine, stated Mr. Latta, can maintain a working thermal efficiency of 22 per cent on gas of uniform quality because the combustion of gaseous fuel is much more ideal and the incidental losses are greatly reduced. The excess of air in gas firing rarely exceeds 10 per cent, whereas with solid fuel in a locomotive this excess often reaches 600 per cent, all of which must be heated to furnace temperature by the combustion of the fuel.

Mr. Lamont is assistant to the president of the Moran Co., Seattle, and Mr. Latta is associated with the Irondale Steel Co., 406 Arcade Annex, Seattle.

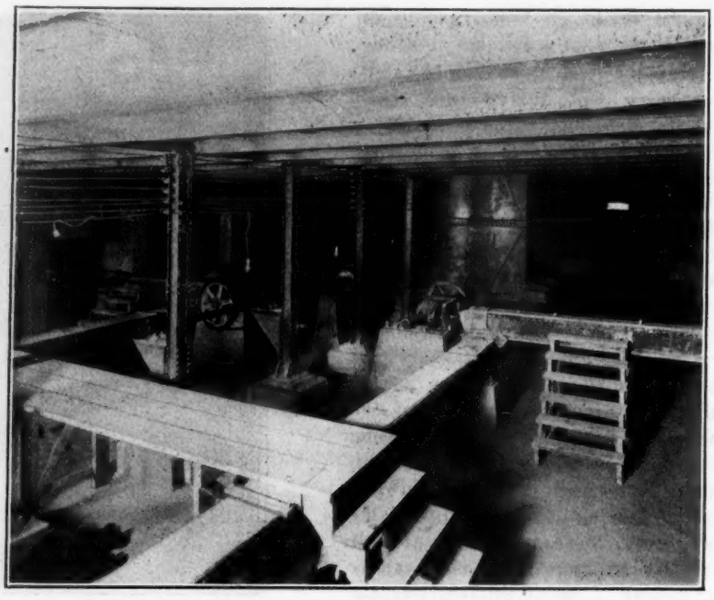


FIG. 18—CONVEYING MACHINERY IN STOCK HOUSE.

Blowing in Stacks.—The Carnegie Steel Co. last week started the first of its blast furnaces at its Bellaire, O., works which has been idle for the past 17 months. Later orders were issued to start a second furnace, and this was done May 17. The Bessemer department, blooming mill and one finishing mill will go on May 24. The company has also put on an additional furnace and finishing mill at its Mingo works, Mingo Junction, O., and that plant is now operating in full. At the present time the Carnegie Steel Co. has 39 out of a total of 59 stacks in operation.

The Laramie rolling mills, at Laramie, Wyo., resumed operating May 9, after having been closed since the last day of February a year ago.

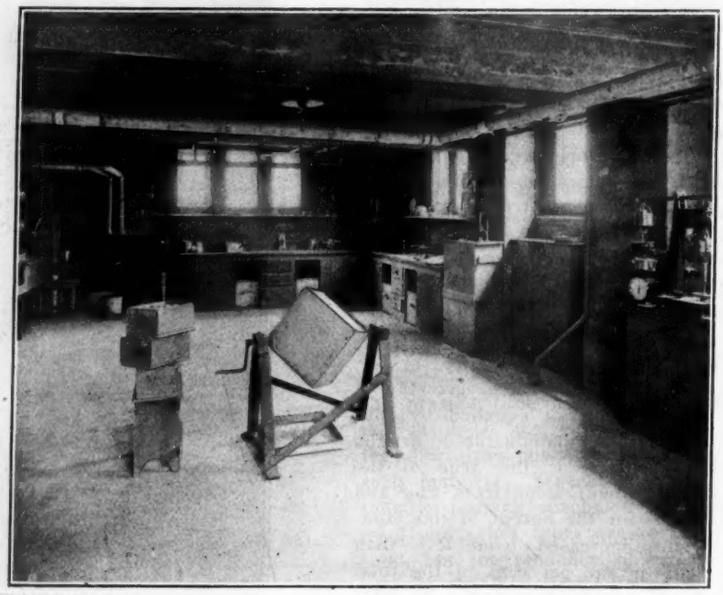


FIG. 19—PHYSICAL TESTING LABORATORY.

PERSONALS.

P. G. March, president of the Cincinnati Shaper Co., has returned from a three months' European visit.

Richard Neff has been elected a director of the Hamilton Iron & Steel Co., Hamilton, O., to succeed F. F. Dinsmore.

Howard A. Knauss has been appointed superintendent of the Emaus, Pa., stack of the Reading Iron Co., succeeding H. J. Cooper, deceased.

Foster Milliken has an office at 806 Bowling Green building, 11 Broadway, New York, in connection with plans for the reorganization of Milliken Bros., Inc.

J. E. Duers has been appointed auditor and purchasing agent of the Calumet Engineering Works, Harvey, Ills., succeeding E. C. Stockdale, who has embarked in business for himself.

Robert Wallace, formerly superintendent of the Buffalo Structural Steel Co., has been appointed superintendent of the new bridge shop of the Manitoba Bridge & Iron Works, Ltd.

Russell Dale, formerly sales manager of the Celfor Tool Co., has been appointed Chicago representative of the Carpenter Steel Co., with offices in the Commercial National Bank building.

W. R. Mason, of Detroit, has been appointed manager of the American Car & Foundry Co.'s plant at Jeffersonville, Ky., replacing G. A. Scanland, who has resumed his duties as traveling auditor.

A. H. Reed, who has resigned as superintendent of mines for the Longdale Iron Co., Longdale, Va., has been named mining and mechanical engineer for the Independent Phosphate Co., Columbia, Tenn.

Herman Neiter, for the past year and a half eastern sales manager for the Canton Boiler & Engineering Co., Canton, O., has been appointed sales manager of the same company with headquarters at Canton.

Arthur T. Rush, until recently assistant secretary and assistant treasurer of the Bethlehem Steel Corporation, is now connected with the investment security house of Mellor & Perty, Philadelphia.

John J. Harman, M. E., has become a member of the Harman Engineering Co., Peoria, Ill. He was formerly with the Link Belt Co., and the National Tube Co., and was also an instructor in the University of Illinois.

D. Elshoff, for 12 years eastern superintendent of the Allis-Chalmers-Bullock Co., of Cincinnati, and for the past two years superintendent of the electric department of the Allis-Chalmers Co. at Milwaukee, has severed his connection with the last named company. For the present he will remain in Milwaukee, but may eventually accept a position with an eastern firm.

John R. Burrows has been chosen secretary of the Platt Iron Works, of Dayton, O., which recently passed into the hands of a new company including George D. Crabbs, of Cincinnati and W. J. Cummins, of Nashville.

W. A. Garrett, president of the Seaboard Air Line Railway Co., it is announced, will become vice president of the T. H. Symington Co., with headquarters in Baltimore, assuming his new duties not later than Nov. 1.

Edmund Lang, who for five years held an executive position with the Wheeler Condenser & Engineering Co., has been placed in charge of the repair shop of the Crocker-Wheeler Co. at Ampere, N. J.

W. W. Merriam, geologist of the United States Steel Corporation, will sail for Rio Janeiro shortly to be absent six months for the purpose of looking over mineral deposits in part of Brazil.

Robert Wuest, of Cleveland, commissioner of the National Metal Trades Association, attended a dinner early in the week of a number of manufacturers in the metal trades located at Newark, N. J., who are desirous of establishing a local labor bureau.

George C. Stone, formerly manager of the Pennsylvania works of the American Sheet & Tin Plate Co. at New Kensington, Pa., has been appointed superintendent of the New Castle, Pa., works of the company, succeeding Bert J. Ross, who recently resigned to take service with the Jones & Laughlin Steel Co. Joseph Hartill, formerly superintendent of the Cambridge, O., plant, has been named superintendent of the Pennsylvania works and J. E. Thompson has been made superintendent at Cambridge.

Louis H. Washburn has been appointed eastern sales agent of the Pittsburg Coal Co., with offices in the United States Express Co. building, No. 2 Rector street, New York City. Arrangements under which B. Nicoll & Co. has been representing the company as eastern sales agent have been discontinued. James H. Woods has been appointed assistant general sales agent for the coal company, with offices in the Rockefeller building, Cleveland.

James Speyer, Edward S. Marsten, president of the Farmers' Loan & Trust Co., and Horace E. Andrews, president of the New York State Railways Co., which is the electric system of the New York Central railroad, have been elected to the executive committee of the Lackawanna Steel Co.

J. H. Hearding, for many years general superintendent of the Oliver Iron Mining Co., at Eveleth, in charge of the Adams-Spruce group of mines, has been appointed assistant general manager of the Oliver Iron Mining Co. Mr. Hearding succeeds Mr. McLean and will be located at Duluth. R. C. Mitchell, formerly superintendent of the Monroe-Tener mine at Chisholm, succeeds Mr. Hearding.

Frank Tickner, superintendent of the Lackawanna Steel Co.'s foundry department at Buffalo, N. Y., has resigned to accept the management of the T. D. West Foundry Co. of Sharpsville, Pa. Mr. Tickner went to Buffalo with the Clarke-McCullough administration of the Lackawanna Steel Co. The vacancy at the Lackawanna plant has been filled by the appointment of Frank Leuthner, who had been assistant superintendent of the foundry department.

Charles R. McCable, representative in the state legislature from Marquette, Mich., has resigned his business connection in that city to accept the position of confidential man for John D. Ryan, president of the Amalgamated Copper Co., and a leading factor in other big mining companies. Mr. McCable will leave shortly for New York.

For Handy Reference.—The Jamison Coal & Coke Co., Pittsburg, has issued a booklet containing iron and steel measurements and weights and other valuable information in form for handy reference. The booklet has been compiled by H. H. Robinson particularly for use by blacksmiths, and deals with weights of round and square steel, cubic contents, size, area and circumference of circles and commonly used formulas, tables, etc.

The Chicago Malleable Castings Co., of West Pullman, Ill., has about completed a two-story office building, new cupola room with electric elevator and modern appliances for economic handling of this branch of its business. The company has been enjoying a steady run through the business depression and is now operating about 90 per cent of its capacity.

The Champion Rivet Co., Cleveland, has appointed as its general New England agent, James J. Sullivan, 72 Mason building, Boston, who for a number of years represented George O. Wales & Co., Boston.

AMONG MACHINERY MAKERS.

PITTSBURG.

Order Books of Builders of Heavy Machinery are Filling.

Office of THE IRON TRADE REVIEW,
510 Park Bldg., May 25.

Builders of heavy machinery for steel works and finishing mill operations report much activity in their line and that order books are filling up rapidly. Some of the companies have about all the work under contract that they can conveniently handle for a number of months ahead. Finishing mill contracts have been quite liberal, as a number of companies are adding to capacities or are building entirely new plants. The additional sheet mills recently placed have been especially numerous. The roll trade is good, and in connection with new mill construction some nice crane business is being closed.

The inquiry for pumps is showing considerable improvement and a number of the coal companies are coming into the market for this class of equipment.

The general machinery market has a better tone throughout, and while in some lines substantial increases of orders have not been noted, the forerunners of business are much more plentiful and promising.

Mill machinery makers are now figuring upon the equipment for the new tin plant which the Jones & Laughlin Steel Co. has planned as a part of its finishing capacity at its new works at Aliquippa, Pa. While no official statement on the project has been issued by the company, it is understood that a 30-mill plant has been contemplated.

The board of public service of Alliance, O., will receive bids up to noon of June 2 for a pump with a daily capacity of 6,000,000 gallons, to be installed in the public water works plant there. Bids will also be received at the same time for the material and labor for an intake line and filter bed.

The Erie Forge Co., Erie, Pa., has fired a new 25-ton open-hearth furnace which was recently completed at its plant.

The A. M. Byers Co., Pittsburg, which recently completed a modern puddle mill at Girard, O., and has in contemplation the extensive enlargement of its South Side works, Pittsburg, has temporarily deferred the further progress of these improvements. It has been the eventual purpose of the company to concentrate its puddle mill activities at Girard and its pipe mills at Pittsburg. The new Girard plant is now steadily operating.

The work of erecting the new plant of the West Penn Steel Co. at Brackenridge, Pa., is proceeding rapidly. Cranes are now running in the open-hearth department and it is expected that the crane system in some of the finishing mills will also be in operation within a few weeks. It is expected that the entire plant will be on a producing basis by September.

The Phillips Sheet & Tin Plate Co. during the past week closed for the rolling equipment for its new tin plate plant now undergoing construction at Holliday's Cove, W. Va. The United Engineering & Foundry Co. will furnish the 12 hot and eight cold mills required. The latter company has also taken the contract for a number of additional sheet mills to be installed in the plant of the Youngstown Sheet & Tube Co., Youngstown, O.

CINCINNATI.

Carriage Manufacturers Turning Attention to Automobiles.

Office of THE IRON TRADE REVIEW,
First National Bank Building, May 25.

Indications are that business during the month of May will equal and possibly exceed the April record. The trade sentiment is decidedly more encouraging in spite of the present dullness. Manufacturers are inclined to regard general business as much improved; and the machine tool interests must eventually share in the betterment of industrial conditions. The worst of the depression has passed, so that the future holds in store increased business. It is not expected that the demand will be sufficient to admit of all of our shops running again to full capacity this year, but there are those who hope that before the close of 1909 the present activities will be double, which would represent a business equal to about 80 per cent of normal.

The meeting of the American Foundrymen's Association in Cincinnati the past week furnished opportunity for a number of the machine tool men to conduct parties of visitors through their shops and a number of the machine tool men were busy making acquaintances among the visitors at the outings and entertainments provided. The Lodge & Shipley Machine Tool Co. had on exhibiton at the Foundrymen's exhibit one of its new type lathes, with R. G. English in charge. The Cincinnati Electrical Tool Co. exhibited one of its portable tools, especially adapted for foundry use. The Triumph Electric Co. exhibited motors in connection with the exhibit of wood-working machinery for the J. A. Fay & Egan Co. The Cincinnati Planer Co. received a number of visitors at its plant.

The carriage manufacturers of Cincinnati are turning attention to the automobile business and one of the largest concerns, Haberer & Co., is arranging to build a plant for the manufacture of autos. The Haberer company is forming a new corporation to take up this branch of the business, to be known as the Cino-Motor Car Co. The capital will be increased from the present $10,000 to $200,000 in the near future. Ground has been broken for the new plant which is to be built on Evans street, between the present plant of the company and Gest street. The first car manufactured by the company was completed this week and tested on the street. The new plant will be equipped to build all parts of the automobile, including the engine.

Several other large buggy manufacturers are working on automobiles and the manufacture of autos in this city bids fair to become an important interest here.

BUFFALO.

Specifications for Machinery are More Numerous.

Office of THE IRON TRADE REVIEW,
932 Ellicott Square, May 25.

Specifications for heavy machinery, machine tools and electrical equipments, are more numerous at this time. There are several large contracts pending here, including one to be given by the city of Buffalo for three 25,000,000-gallon triple expansion pumping engines, which will be used in connection with the new waterworks system. It is generally believed that this contract will be given to either the Allis-Chalmers Co., of Milwaukee, or the International Steam Pump Co. The new waterworks system, roughly estimated, will cost the city about $3,000,000, and as the work nears completion there will be a number of substantial contracts let. A boiler plant will be one of the early contracts. Bids have just been opened by the city of Buffalo for a power plant for lighting the city and county hall by electricity. The contract has not been awarded, but the cost will be about $25,000. Bids have also been opened for power equipments, including

two 100-kilowatt generators, engines and boilers, also more electrical equipment aggregating about $50,000. Another contract which will likely be let at an early date, is that of the Onondaga Hotel Co., of Syracuse, for its power and lighting plant.

There are several enterprises in Buffalo, which will call for considerable power and electrical equipment, including the extensive plants proposed by the Lackawanna Bridge Co., and the Corrugated Bar Co., of St. Louis, which will build here, and a large hotel enterprise, also in Buffalo. The Allis-Chalmers Co. has closed a contract to furnish Adler Bros., of Rochester, N. Y., one 165-kilowatt direct current generator, one 62½-kilowatt generator, 10-kilowatt generator, for the new power plant, also milling machinery and seven roller mills for the Husted Milling & Elevator Co., of Buffalo, which suffered fire loss, and another order from J. A. Hines Co., of Rochester, N. Y., for machinery and mills. The same company has a force of men in Buffalo installing the 18-kilowatt turbine for the Washburn-Crosby Co. This turbine will be electrically operated, and the whole contract for machinery and electricity figures about $250,000.

MILWAUKEE.

Orders Increase Both to Large and Small Wisconsin Shops.

Milwaukee, Wis., May 22.—Orders seem to be increasing and inquires showing more life not only with the machinery manufacturing concerns of Milwaukee but with many plants about Wisconsin. Manufacturers say that while the larger plants have been experiencing a larger business only during the past few months, the smaller concerns have been meeting with readier orders for a much longer period.

The Lauson-Lawton Co., of DePere, Wis., manufacturers of gasoline engines, have been meeting with a good run of business of late. The company recently received an order for three of its engines to be shipped to Norway.

A heavy run of orders was received by many of the larger Milwaukee plants last week. At the West Allis works of the Allis-Chalmers Co. there is great activity in the gas engine building line, as a result of recent orders crowding close upon others received since the first of the year, the units for which are now being assembled for shipment.

The Bucyrus Co., of South Milwaukee, recently sold a locomotive pile-driver and four ballast unloaders to the Southern Pacific Railway. The Bucyrus Co., has also contracted to furnish another steam dredge for government service to be used on irrigation work in the state of Washington.

The Wisconsin Machinery & Mfg. Co., of Milwaukee, is supplying a demand for its new two-cycle, three-port engines, which are being placed on the market in sizes from 7 to 50 horsepower, suitable for high grade automobiles, trucks and motor buggies.

The Southern Wisconsin Power Co., of Madison, Wis., has been installing considerable new equipment of late, including a 30-ton traveling Northern crane and a 6-ton electric mono-rail hoist.

It is expected that more than 100 manufacturing plants will be represented at the annual convention of the National Machinists and Tool Builders' Association which will convene at the Plankinton, Milwaukee, May 25 and 26.

The Cutler-Hammer Mfg. Co. of Milwaukee has manufactured all of the electrical machinery which will be installed on all four new United States battleships of the Dreadnought type, the Delaware, North Dakota, Florida and Utah. Besides steering machinery, the equipment will include power apparatus for operating rotating turrets, hoisting ammunition, ramming the charge, closing the breech of the gun, and elevating or depressing the guns themselves. This machinery, while doing heavy work, must have an elaborate nicety of control and the Cutler-Hammer Co. has been meeting with much success in this peculiar field.

SEATTLE.

Machine Tool Business Dull, but Other Lines Are Active.

Office of THE IRON TRADE REVIEW,
302 Pioneer Bldg., May 21.

The machine tool business on the Pacific coast is dull at present, but in most other lines the trade is active. Contractors' machinery and small engines and boilers are moving most briskly. The sales of lumbering and saw mill machinery are in larger volume than they have been for 60 days. There are a number of new projects under way which are requiring, or will require in the near future, a considerable amount of new machinery.

The Moran Co., Seattle, has recently shipped two large steel stacks to the Irondale Steel Co., Irondale, Wash. The stacks are 90 feet long and 9 feet in diameter. Forty-five tons of castings for the new open-hearth furnaces were also recently shipped to Irondale by the Moran Co.

Imports of structural materials and pig iron into the port of San Francisco during March, 1909, were as follows:

Pig iron	3,438,000 pounds.
Bar iron	376,320 pounds.
Steel rails	110,000 pounds.
Steel ingots	1,166,679 pounds.
Structural steel	505,209 pounds.

The National Foundry Co., Tacoma, Wash., has prepared plans for the erection of a new pattern shop at its works at 5821 South Adams street, South Tacoma.

The Tacoma Ornamental Iron Works, Tacoma, has taken a contract for fitting the entire plant of the Dupont Powder Co., at Dupont, Wash., with ornamental iron window guards.

The Byron Jackson Iron Works has opened an office at 616 Mutual Life Building, Seattle. The new offices will have charge of the sales of pumps, dredging machinery, etc., throughout the northwest and Alaska. A. C. Bark is manager of the local office.

Col. E. A. Wall and Reuben May, Salt Lake, Utah, proprietors of the Salt Lake Engineering Works, are making plans for a steel castings foundry to cost $50,000.

L. W. Spaulding will construct a machine shop 50 by 100 feet in size at Lewistown, Mont.

The Northwest Bridge Works, Portland, Ore., has secured a contract for the erection of a five-story steel building at Salem, Ore. The building is to cost about $100,000.

T. W. Fairchild, of Spokane, is organizing a company with a capital of $50,000 to build a factory for the manufacture of irrigation pumps.

The foundry, pattern room and cleaning department of the Northwest Stove Works at the state penitentiary, Salem, Ore., was recently completely destroyed by fire entailing a loss of $30,000. The state will probably rebuild the plant.

DETROIT.

Some Builders Find Business Compares With Banner Month.

Detroit, Mich., May 24.—Frederick Eberle, secretary of the C. C. Wormer Machinery Co., says that the first four months of the present year have been as good as for the corresponding months of the year 1906—the banner one of the machinery trade. He is of the belief that the remainder of

the year will turn out as good. "The demand for metal working machinery is especially encouraging," said Mr. Eberle, "and there is a steady demand for wood working machinery, also. We have a large number of inquiries ahead and the orders coming in are large, although we are not running overtime." Mr. Eberle reports that the demand is well spead out, not being especially urgent in any one section of the country where his company does business. Equipment is being put in by many concerns which held off last year.

Roehm & Davison, Ltd., 91 Woodbridge street, who have hitherto dealt in iron and steel only in small quantities, in connection with their regular carriage goods business, have secured the entire ground floor of the McMillan building next door east. On June 1 they will install a wholesale department devoted to the sale of bar steel, bar iron, hoops, bands, channels, angles, tees, sheet iron, rivets, etc. The new department will be in charge of Fred Wittman, at present on the road for the company.

Henry W. Horton, secretary of Buhl Sons Co., 103 Woodbridge street, manufacturer of iron, steel, nails, etc., reports that business thus far this year has been very satisfactory; that there has been an even demand for iron and steel plates and that the outlook is of the best. "There has been no spurt in the trade," said Mr. Horton, "and we are not rushed with orders, but we are continuing to make satisfactory deliveries."

Casting aluminum has recently been developed at the Carroll foundry in Houghton. Thus far it has been utilized only for making propeller wheels for motor boats. A vulcanizer for automobile tires recently has been added to the apparatus at the foundry.

G. T. Eames, of Kalamazoo, formerly connected with the Belmer-Eames Tool Co., of Cincinnati, and E. D. Myers, of Canton, O., who has been connected with the Canton Spring Co. and with D. W. Shuler & Son, of Amsterdam, N. Y., are planning to locate a factory in Kalamazoo for the manufacture of planers, now made in Cincinnati. The concern wishes to organize with $40,000 capital stock.

Detroit men who attended the American Foundrymen's Association in Cincinnati, have returned rejoicing in the election as president of A. T. Waterfall, general superintendent of the Russel Wheel & Foundry Co. The Detroit delegates went to Cincinnati determined, if possible, to place Mr. Waterfall in some office. Mayor Breitmeyer, the board of commerce and F. B. Stevens with other Detroit foundry supply men aided in the movement to bring the general convention here next year.

The American Feed Water Heater Co., Laurium, Mich., is equipping an engine of the D. S. S. & A. railroad with its device at the Marquette shops. The work will be completed in two weeks. John W. Currie, the inventor, is personally looking over the building of this first heater. The claim made for the invention is that the heater will use a percentage of the exhaust steam to heat the water before it passes into the main boiler.

WORCESTER, MASS.

Many Machine Shops in New England Running Better Time.

Worcester, Mass., May 24.—The new owners of the Hinsdale, Mass., plant of the Haile & Frost Mfg. Co. have organized under the name of the Hinsdale Power & Mill Co., with a capital of $40,000. O. C. Robertson is president.

Reports from some of the leading manufacturing firms in this city indicate a considerable betterment in business conditions.

The Worcester Pressed Steel Co. is sold four months ahead. The company plans to add a new building, 90 x 104 feet, two stories, brick, mill construction at an estimated cost of about $12,000.

The Spencer Wire Co. is running full force and full time with about 400 men.

The Heald Machine Co., grinding machinery, is working 85 men, the largest number ever in its employ. The company is buying new machinery and adding workmen.

Curtis & Marble Machine Co. has been running 59 hours per week since November, with full force of men. A new building is being erected.

The Norton Co. is working full time and full force; the Norton Grinding Co., full time and nearly full force. The Norton Co. is planning the erection of a branch works at Wessling, Germany.

The Coes Wrench Co. has been working full time since December.

The Hamblin & Russell Mfg. Co., maker of wire goods, is planning a new building 40 x 80 feet, to be used for storage and stock rooms. It has been running full time since January, with full force of about 275 men.

The Crompton & Knowles Loom Works have about 2,200 men working in the consolidated works.

The Whitcomb-Blaisdell Machine Tool Co. is now working about half full force. Working time is now 55 hours per week. Orders both from home and abroad have been coming in better during the last week.

The Prentice Bros. Co. recently went back to full time. It makes drills and lathes.

Wyman & Gordon Co., maker of drop forgings, is working 24 hours per day.

NORMAL CONDITIONS

Being Approached by Plants in Lower Susquehanna Valley.

Harrisburg, May 24.—Conditions in the lower Susquehanna valley are gradually resuming the normal and with the business already in sight and placed there are indications of a fairly busy summer. The number of idle furnaces in Dauphin, Lebanon and Berks counties has decreased this month, Paxton No. 1 in this city being the latest to start. The Pennsylvania Steel Co. is operating three furnaces at Steelton and one in this city, while the Lebanon stacks are working.

Announcement has been made of placing of several bridge orders with the Pennsylvania Steel Co.

The steel and plate mills in this city, Lebanon, Reading, Coatesville and Columbia have been gradually increasing their production this month, some of the plants being in operation at the rate of 90 per cent.

Whiting Equipment.—In the list of manufacturers who furnished equipment for the plant of the Indiana Steel Co., at Gary, published in the issue of THE IRON TRADE REVIEW of May 20, the Whiting Foundry Equipment Co., Harvey, Ill., should have been included under the head "Electric Overhead Traveling Cranes," as well as under "Yard and Shop Overhead Cranes," and also under the head "Equipment for Auxiliary Shops." The Whiting Foundry Co. furnished cupolas, ladles, core ovens, iron work, etc., for the foundry.

The Indiana Steel Co., Gary, Ind., has placed an order for 21 form W motors aggregating 655 horsepower of the type developed by the Crocker-Wheeler Co., for rolling mill service. These machines will be used to operate cranes on a 220-volt direct current circuit.

EXPERIMENTS UPON THE FORCES ACTING ON TWIST-DRILLS WHEN OPERATING ON CAST IRON AND STEEL[1]

By Dempster Smith[2] and R. Poliakoff.[3]

(Continued from Iron Trade Review May 6-20, 1909.)

Medium Steel Experiments: Torque.

The trials (f) on medium hard steel are much more regular than those obtained with cast iron. The torque has been plotted as an ordinate on a base of feed per revolution in Fig. 11 and on a base of diameter of drill in Fig. 13. Like the cast iron it does not increase as fast as the feed.

A similar character to the cast iron curve is observed in the variation of torque with diameter. The curves show that so far as the torque is concerned,

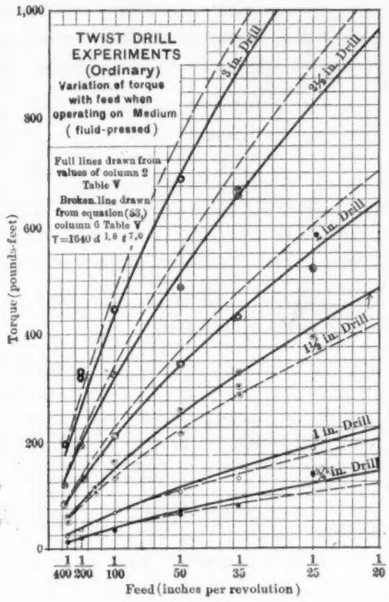

TWIST DRILL EXPERIMENTS
(Ordinary)
Variation of torque with feed when operating on Medium (fluid-pressed)
Full lines drawn from values of column 2 Table V
Broken line drawn from equation (33) column 6 Table V
T=1640 d 1.6 f 7.6
Torque (pounds-feet)
Feed (inches per revolution)
3 in. Drill
2½ in. Drill
2 in. Drill
1½ in. Drill
1 in. Drill
½ in. Drill

Fig. 11.

the most economical way to machine metal is to use a coarse feed and a large diameter of drill.

The full lines, Figs. 11 and 13, agree with the equations given in columns 2 and 3 of Table V respectively. Those in the latter column are the values deduced for each size of drill from the general expression:

$$T = 2{,}300 d^{1.25} \frac{1 + 0.64}{t^{.8} d} \quad \ldots\ldots\ldots\ldots\ldots\ldots (31)$$

The fourth column of the table gives a linear law for each drill and the fifth the values deduced from the general expression given at the top of that column.

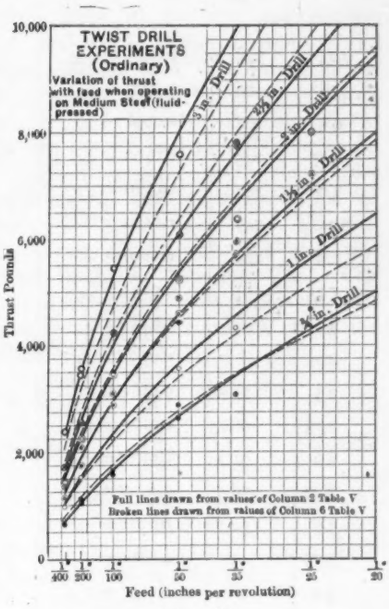

TWIST DRILL EXPERIMENTS
(Ordinary)
Variation of thrust with feed when operating on Medium Steel (fluid-pressed)
Full lines drawn from values of Column 2 Table V
Broken lines drawn from values of Column 6 Table V
Thrust Pounds
Feed (inches per revolution)
3 in. Drill
2½ in. Drill
2 in. Drill
1½ in. Drill
1 in. Drill
½ in. Drill

Fig. 12.

These, however, whilst simple, are rather approximate. For a rough comparison, the form

$$T = 28d^2 \, [1 + 100t] \quad \ldots\ldots\ldots\ldots\ldots (32)$$

is fairly near the mark for all feeds in common use. For ordinary practical use the index of t, which varies very little from 0.70, can be made constant and the coefficient modified to suit.

With this object in view, the following fairly simple and approximate expression is afforded:

$$T = 1{,}640 d^{1.8} \, t^{0.8} \quad \ldots\ldots\ldots\ldots\ldots (33)$$

Medium Steel Experiments: Thrust.

The thrust for medium steel has been plotted as an ordinate on the base of feed per revolution of the drill in Fig. 12 and on a base of diameter of drill in Fig. 14. It will be observed that these results are much more regular than those obtained on cast iron. The diagram clearly shows that the end-thrust does not increase so fast as the feed for a given diameter of drill; neither does it increase as fast as the diameter for a given feed.

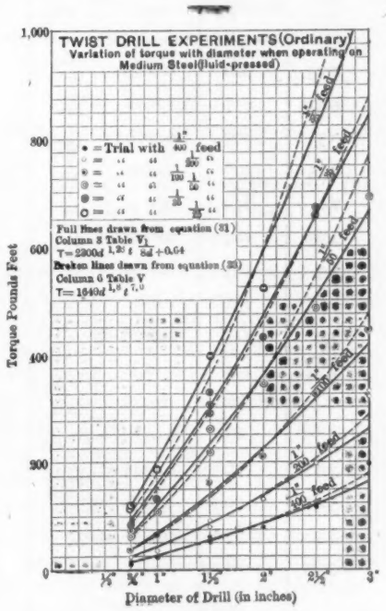

TWIST DRILL EXPERIMENTS (Ordinary)
Variation of torque with diameter when operating on Medium Steel (fluid-pressed)
Full lines drawn from equation (31) Column 3 Table V
Broken lines drawn from equation (33) Column 6 Table V
Torque Pounds Feet
Diameter of Drill (in inches)

Fig. 13.

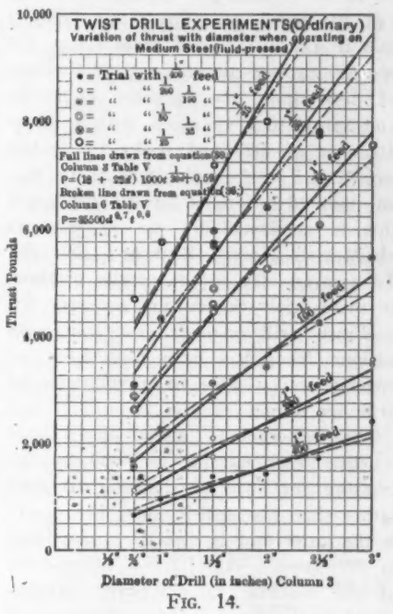

TWIST DRILL EXPERIMENTS (Ordinary)
Variation of thrust with diameter when operating on Medium Steel (fluid-pressed)
Full lines drawn from equation (32) Column 3 Table V
Broken line drawn from equation (33) Column 6 Table V
Thrust Pounds
Diameter of Drill (in inches) Column 3

Fig. 14.

The full lines given on Fig. 12 correspond to the equations given in column 2 of Table V. These have been combined to give the general formula:

$$P = [18 + 22d] \; 1{,}000 t^{1.20} d^{1.80} \quad \ldots\ldots (34)$$

which is represented by the full lines on Fig. 14.

A rougher but simpler rule:

$$P = 750d \, (1 + 150t) \quad \ldots\ldots\ldots\ldots\ldots (35)$$

is fairly correct for the range of feeds used in practice.

With the object of further simplifying equation (34) the index of t has been taken as 0.6 throughout, and the coefficients given in column 2 modified

[1]Abstract of a paper read before the Institution of Mechanical Engineers (Great Britain), March 18, 1909.

[2]Associate member of the Municipal School of Technology, Manchester.

[3]Imperial Technical Institute, Moscow.

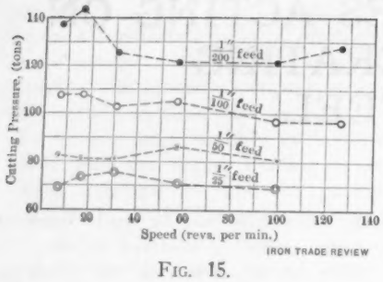


FIG. 15.

to suit. These closely agree with the equation

$$P = 35{,}500\ d^{0.7}\ f^{0.8} \quad \ldots\ldots\ldots\ldots\ldots\ldots (36)$$

which correspond to the values for each diameter of drill given in column 6 of Table V and shown by the dotted lines on Figs. 12 and 14.

Variation of Cutting Stress with Cutting Speed.

The experiments discussed up to the present were made at a constant speed of 10 revolutions per minute. In trials (g) the speed, when operating on soft cast iron (dry), varied from 7.5 to 126 revolutions per minute, with the object of determining the variation of thrust and torque due to speed with a given diameter of drill and feed. In neither case could it be said that there was any marked difference due to speed, and this is confirmed by the experiments of Messrs. Norris, Bird and Fairfield. To give an idea of the results obtained in these trials the cutting pressure for a 2-inch drill on soft cast iron with various feeds has been plotted as an ordinate on a base of revolutions of drill per minute in Fig. 15.

The experiments show that metal is most economically removed by increasing the feed or diameter of drill rather than the speed; since the power in the latter case is directly proportional to the speed. The friction horsepower of the machine is practically proportional to the speed, so that if the speed

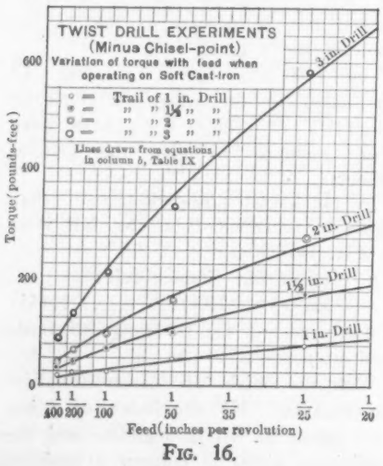

TWIST DRILL EXPERIMENTS
(Minus Chisel-point)
Variation of torque with feed when operating on Soft Cast-Iron
Trail of 1 in. Drill
Lines drawn from equations in column 5, Table IX
Torque (pounds-feet)
Feed (inches per revolution)
3 in. Drill
2 in. Drill
1 in. Drill

FIG. 16.

TABLE VII.—*Revolutions per minute, feed per revolution, cubic inches removed per minute, and horse-power when drilling cast-iron.*

1 Diameter of drill, inches.	2 R. P. M. at cutting speed of 48 feet per minute $N = \frac{12 \times 48}{\pi d}$	3 Feed in inches per revolution of drill $= \frac{d}{84}$	4 Cubic inches removed per minute $1.715 d^{\frac{1}{2}}$	5 Cutting horse-power $1.16d$	6 Feeding horse-power $\frac{d^{\frac{1}{2}}}{142}$	7 Total horse-power	8 Horse-power per cubic inch of metal removed per minute
0.25	735	$0.0075 = \frac{1}{133}$	0.27	0.29	0.005	0.295	1.092
0.375	490	$0.0086 = \frac{1}{116}$	0.462	0.435	0.0055	0.4405	0.954
0.5	368	$0.0094 = \frac{1}{106}$	0.682	0.58	0.0059	0.586	0.862
0.75	245	$0.0109 = \frac{1}{92}$	1.17	0.87	0.0066	0.8766	0.748
1.0	184	$0.0119 = \frac{1}{84}$	1.715	1.16	0.007	1.167	0.681
1.25	147	$0.0129 = \frac{1}{77.5}$	2.32	1.45	0.0073	1.457	0.628
1.5	122	$0.0136 = \frac{1}{74}$	2.92	1.74	0.0078	1.748	0.598
1.75	105	$0.0144 = \frac{1}{69.5}$	3.63	2.03	0.0081	2.038	0.563
2.0	92	$0.015 = \frac{1}{67}$	4.32	2.32	0.0084	2.328	0.539
2.25	81.7	$0.0156 = \frac{1}{64}$	5.05	2.61	0.0085	2.619	0.519
2.5	73.5	$0.0162 = \frac{1}{62}$	5.82	2.9	0.0089	2.909	0.500
2.75	66.75	$0.0167 = \frac{1}{60}$	6.6	3.19	0.0091	3.199	0.486
3.0	61.3	$0.0172 = \frac{1}{58.4}$	7.4	3.48	0.0093	3.489	0.472
3.25	56.5	$0.0176 = \frac{1}{57}$	8.22	3.77	0.0095	3.78	0.46
3.5	52.5	$0.0181 = \frac{1}{55.4}$	9.05	4.06	0.0096	4.07	0.45
3.75	49	$0.0185 = \frac{1}{54}$	10.0	4.35	0.0098	4.36	0.436
4.0	46	$0.019 = \frac{1}{52.8}$	10.8	4.64	0.00095	4.65	0.431

TABLE VIII.—*Revolutions per minute, feed per revolution, cubic inches removed per minute, and horse-power when drilling medium hard steel*

1 Diameter of drill, inches.	2 R. P. M. at cutting speed of 60 feet per minute $N = \frac{12 \times 60}{\pi d}$	3 Feed in inches per revolution $= \frac{d^{\frac{1}{2}}}{100}$	4 Cubic inches removed per minute $1.8 d^{\frac{1}{2}}$	5 Cutting horse-power $2.85d$	6 Feeding horse-power $\frac{d^{\frac{1}{2}}}{77}$	7 Total horse-power	8 Horse-power per cubic inch of metal removed per minute
0.25	920	$0.0063 = \frac{1}{160}$	0.284	0.712	0.0092	0.721	2.54
0.375	614	$0.0072 = \frac{1}{139}$	0.485	1.068	0.0102	1.078	2.22
0.5	460	$0.00795 = \frac{1}{126}$	0.716	1.425	0.0109	1.426	1.99
0.75	306	$0.0091 = \frac{1}{110}$	1.23	2.14	0.0121	2.152	1.75
1.0	230	$0.01 = \frac{1}{100}$	1.8	2.85	0.013	2.863	1.59
1.25	184	$0.0108 = \frac{1}{92.5}$	2.44	3.56	0.0138	3.574	1.47
1.5	153	$0.0114 = \frac{1}{88}$	3.08	4.27	0.0145	4.285	1.39
1.75	131	$0.0121 = \frac{1}{83}$	3.81	4.90	0.015	5.005	1.31
2.0	115	$0.0126 = \frac{1}{79.5}$	4.54	5.7	0.0155	5.715	1.26
2.25	102	$0.0131 = \frac{1}{76.5}$	5.3	6.42	0.0159	6.436	1.21
2.5	92	$0.0136 = \frac{1}{73.5}$	6.12	7.12	0.0163	7.136	1.165
2.75	83.5	$0.014 = \frac{1}{71.5}$	3.92	7.84	0.0167	7.857	1.135
3.0	76.5	$0.0144 = \frac{1}{69.5}$	7.76	8.55	0.0171	8.567	1.105
3.25	70.5	$0.0148 = \frac{1}{67.5}$	8.66	9.25	0.0175	9.267	1.07
3.5	65.6	$0.0151 = \frac{1}{66}$	9.5	9.98	0.0178	9.998	1.05
3.75	61.25	$0.0155 = \frac{1}{64.5}$	10.48	10.7	0.0181	10.718	1.024
4.0	57.5	$0.0158 = \frac{1}{63}$	11.4	11.4	0.0184	11.42	1.0

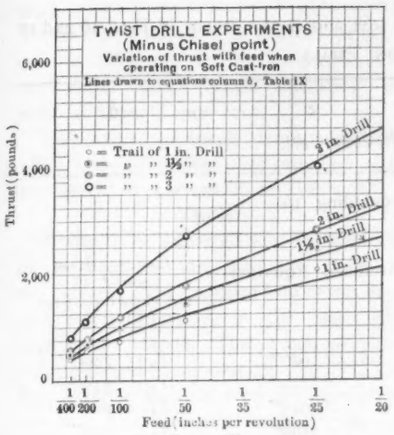

TWIST DRILL EXPERIMENTS
(Minus Chisel point)
Variation of thrust with feed when operating on Soft Cast-Iron
Lines drawn to equations column 8, Table IX
Thrust (pounds)
Feed (inches per revolution)
3 in. Drill
2 in. Drill
1½ in. Drill
1 in. Drill

FIG. 17.

is doubled, the power is also doubled. When the feed on the other hand is doubled, the frictional horsepower remains about the same.

By increasing the number of lips to three or more, the torque and the thrust are increased for any given feed as the feed actually taken by each lip is $\frac{1}{n}$ of the whole feed, where n is the number of lips. No attempt has been made to determine the most durable speed for a given feed and diameter of drill. Tables VII and VIII have been calculated from the above results for the speed and feed recommended by drill makers for ordinary workshop use.

There is no general agreement among the makers of high-speed twist-drills as to what the cutting speed should be for ordinary workshop practice. Some decrease the speed with the increase of diameter of drill, some recommend the reverse, but the most makers advise a constant peripheral speed throughout. The mean of these values is about 60 feet per minute with a feed per revolution of $\frac{d^{1/3}}{100}$ for mild steel. For cast iron it is usual to decrease the above speed 20 per cent and increase the feed by a similar amount. Using these figures and the experimental force values given herein an estimate of the net horsepower required for drilling can be made. With the object of presenting these results in concise form and to show at a glance the influence of speed, feed and diameter, the values so deduced have been tabulated in Tables VII and VIII. Column 4 gives the cubic inches of material removed per minute V from the formula

$$V = \frac{\pi}{4} d^2 \, t \, N.$$

$= 1.715 d^{4/3}$ for cast iron, and

$V = 1.8 d^{4/3}$ for mild steel.

N in both cases being revolutions per minute.

Cutting horsepower in column 5 is determined by the formula

$$\text{C. H. P.} = \frac{2\pi NT}{33{,}000}$$

$= 1.16 d^{1.032} =$ say $1.16d$, for cast iron.

or

$= 2.85 d^{0.983} =$ say $2.85d$. for medium steel.

The horsepower required for feeding in column 6 is obtained by multiplying the end force for each feed and diameter of drill by the feed per revolution and the revolutions per monute.

$$\text{F. H. P.} = P \, t \, N$$

$$= \frac{d^{0.78}}{142} = \frac{d^{1/4}}{142} \text{ say for cast iron.}$$

or

$$= \frac{d^{0.223}}{0.77} = \text{say } \frac{d^{1/4}}{77} \text{ for medium steel.}$$

Minus Chisel-Point Experiments (h) on Soft Cast Iron and Medium Steel.

These experiments were undertaken with the object of determining the difference in the thrust and torque due to the chisel point of the drill. Many efforts were made at the outset to drill a hole with a chisel shaped and ground similar to that on the drill itself. Frequent breakages, particularly when operating on steel, led to the abandonment of this procedure in favor of that where a hole was initially made in the specimen, having a diameter equal to the width of the chisel point of the drill to be employed. The tests were then made with different feeds and

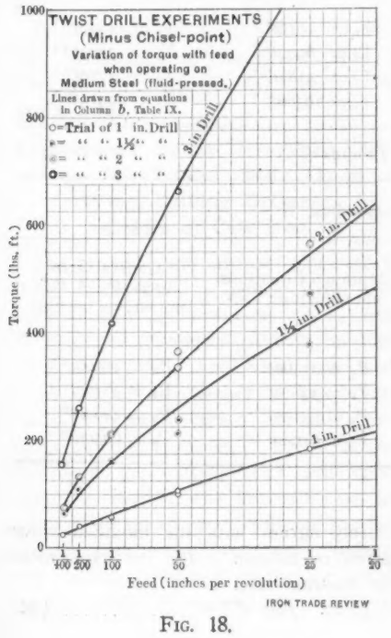

TWIST DRILL EXPERIMENTS
(Minus Chisel-point)
Variation of torque with feed when operating on Medium Steel (fluid-pressed).
Lines drawn from equations in Column b, Table IX.
Torque (lbs. ft.)
Feed (inches per revolution)
IRON TRADE REVIEW
3 in. Drill
2 in. Drill
1½ in. Drill
1 in. Drill

FIG. 18.

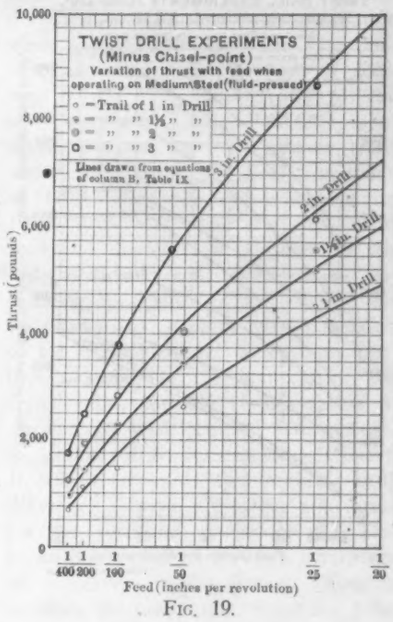

TWIST DRILL EXPERIMENTS
(Minus Chisel-point)
Variation of thrust with feed when operating on Medium Steel (fluid-pressed)
Lines drawn from equations of column 8, Table IX
Thrust (pounds)
Feed (inches per revolution)
3 in. Drill
2 in. Drill
1½ in. Drill
1 in. Drill

FIG. 19.

diameters of drills at a speed of 10 revolutions per minute as in the ordinary trials previously discussed.

Torque.

The torques obtained in these trials have been plotted as ordinates on a base of feed per revolution on Fig. 16 and Fig. 18 for cast iron and steel respectively.

The equations to the lines drawn on the figure are given in column b of Table IX.

These may be combined to give a general law in terms of d or $d—d_1$ and t, where d_1 is the diameter of the chisel point.

For comparison with the ordinary drill trials it may be more convenient to have the general equation in terms

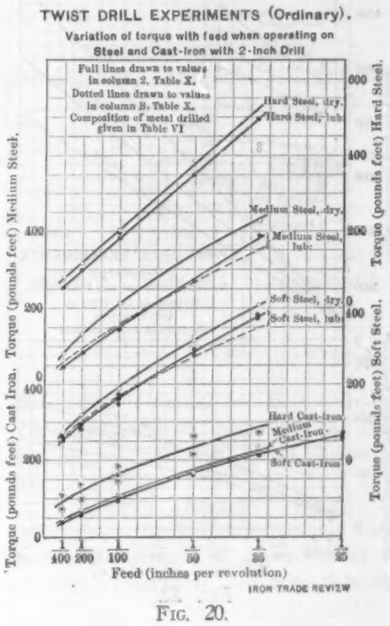

TWIST DRILL EXPERIMENTS (Ordinary).
Variation of torque with feed when operating on Steel and Cast-Iron with 2-Inch Drill
Full lines drawn to values in column 2, Table X.
Dotted lines drawn to values in column B, Table X.
Composition of metal drilled given in Table VI
Torque (pounds feet) Cast Iron. Torque (pounds feet) Medium Steel.
Torque (pounds feet) Hard Steel. Torque (pounds feet) Soft Steel.
Feed (inches per revolution)
IRON TRADE REVIEW
Hard Steel, dry.
Hard Steel, lub.
Medium Steel, dry.
Medium Steel, lub.
Soft Steel, dry.
Soft Steel, lub.
Hard Cast-Iron.
Medium Cast-Iron.
Soft Cast-Iron

FIG. 20.

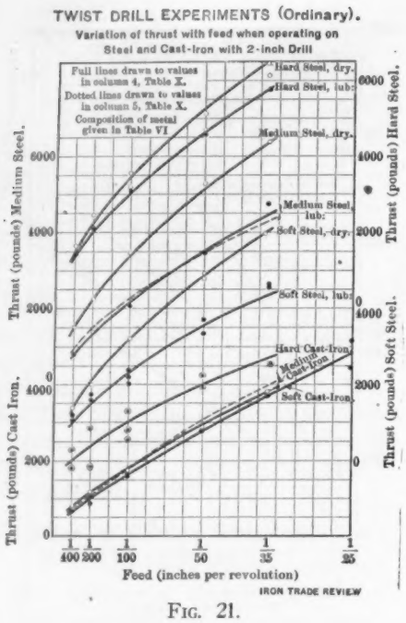

TWIST DRILL EXPERIMENTS (Ordinary).
Variation of thrust with feed when operating on Steel and Cast-Iron with 2-inch Drill
Full lines drawn to values in column 4, Table X.
Dotted lines drawn to values in column 5, Table X.
Composition of metal given in Table VI
Hard Steel, dry.
Hard Steel, lub.
Medium Steel, dry.
Medium Steel, lub.
Soft Steel, dry.
Soft Steel, lub.
Hard Cast-Iron
Medium Cast-Iron
Soft Cast-Iron
Thrust (pounds) Medium Steel.
Thrust (pounds) Hard Steel.
Thrust (pounds) Cast Iron.
Thrust (pounds) Soft Steel.
Feed (inches per revolution)
IRON TRADE REVIEW

FIG. 21.

of d and t only. If the cutting pressure is desired an equation in terms of d and d_1 would be necessary. Combining the equations given in column b and modifying them so that the index of t is 0.7 (see column c) (which is almost the average value) the general expression for the trials on cast iron is obtained:

$$T_o = 740\ d^{1.8}\ t^{0.7} \quad \ldots\ldots\ldots\ldots\ldots\ldots (37)$$

which is identical with that given for the ordinary trials on this metal (see equation (21). Of course, the torque in this latter set of experiments should be smaller, but the difference is so little as to be lost sight of in the approximations made. If the cutting pressure is worked out as in the case of the ordinary trials, the difference due to chisel point will be found to be insignificant.

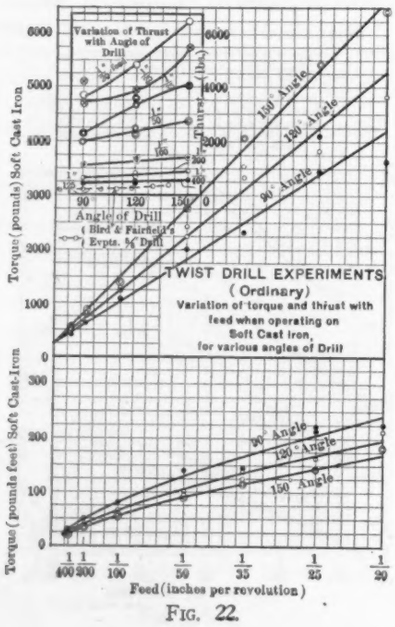

Variation of Thrust with Angle of Drill
Torque (pounds) Soft Cast Iron
Thrust (lbs.)
Angle of Drill
(Bird & Fairfield's Expts. ¾" Drill
TWIST DRILL EXPERIMENTS
(Ordinary)
Variation of torque and thrust with feed when operating on Soft Cast Iron, for various angles of Drill
150° Angle
120° Angle
90° Angle
Torque (pounds feet) Soft Cast-Iron
Feed (inches per revolution)

FIG. 22.

TABLE IX.

Values corresponding to equations given in the text and curves drawn on Figs. 16 and 17

SOFT CAST-IRON TRIALS.

a	b	c	d
	Torque in Pounds Feet.		
Diameter of Drill, d inches.	Equations corresponding to— Full lines on Fig. 16	Modified Equations not shown on Figs.	General Law $740d^{1.8}\ t^{0.7}$ not shown on Figs
1.0	$T_o = 630t^{0.858}$	$T_o = 680t^{0.7}$	$T_o = 740t^{0.7}$
1.5	$T_o = 1325t^{0.65}$	$T_o = 1710t^{0.7}$	$T_o = 535t^{0.7}$
2.0	$T_o = 2180t^{0.66}$	$T_o = 2625t^{0.7}$	$T_o = 2580t^{0.7}$
3.0	$T_o = 5250t^{0.66}$	$T_o = 5500t^{0.7}$	$T_o = 5330t^{0.7}$
	Thrust in Pounds.		
Diameter of Drill, d inches.	Equations corresponding to— Full lines on Fig. 17.	Modified Equations not shown on Figs.	General Law $1260d^{0.7}\ t^{0.06}$ not shown on Figs.
1.0	$P_o = 13180t^{0.607}$	$P_o = 12792t^{0.6}$	$P_o = 12600t^{0.6}$
1.5	$P_o = 16600t^{0.607}$	$P_o = 16120t^{0.6}$	$P_o = 16730t^{0.6}$
2.0	$P_o = 19950t^{0.607}$	$P_o = 19372t^{0.6}$	$P_o = 22450t^{0.6}$
3.0	$P_o = 29170t^{0.607}$	$P_o = 28320t^{0.6}$	$P_o = 27200t^{0.6}$

Values corresponding to equations given in the text and curves drawn on Figs. 18 and 19.

MODERN STEEL TRIALS.

a	b	c	d
	Torques in Pounds Feet		
Diameter of Drill d inches.	Equations corresponding to— Full lines on Fig. 18.	Modified equations not shown on Figs.	General Law $1620d^{1.7}\ t^{0.7}$ not shown on Figs.
1.0	$T_o = 2000t^{0.846}$	$T_o = 1616t^{0.7}$	$T_o = 1620t^{0.7}$
1.5	$T_o = 3700t^{0.670}$	$T_o = 4042t^{0.7}$	$T_o = 3225t^{0.7}$
2.0	$T_o = 5200t^{0.701}$	$T_o = 5184t^{0.7}$	$T_o = 5270t^{0.7}$
3.0	$T_o = 10600t^{0.705}$	$T_o = 10380t^{0.7}$	$T_o = 10470t^{0.7}$
	Thrust in Pounds.		
Diameter of Drill d inches.	Equations corresponding to— Full lines on Fig. 19.	Modified Equations not shown on Figs.	General Law $27000d^{0.752}\ t^{0.6}$ not shown on Figs.
1.0	$P_o = 36000t^{0.659}$	$P_o = 27460t^{0.6}$	$P_o = 27000t^{0.6}$
1.5	$P_o = 40000t^{0.63}$	$P_o = 34880t^{0.6}$	$P_o = 36300t^{0.6}$
2.0	$P_o = 42500t^{0.592}$	$P_o = 44192t^{0.6}$	$P_o = 44800t^{0.6}$
3.0	$P_o = 60000t^{0.593}$	$P_o = 61900t^{0.6}$	$P_o = 60300t^{0.6}$

The general equation which most closely agrees with the modified values given in column c for the experiments on medium steel is

$$T_o = 1{,}620\ d^{1.7}\ t^{0.7} \quad \ldots\ldots\ldots\ldots\ldots\ldots (38$$

and the value obtained in the ordinary trial is

$$T_o = 1{,}640\ d^{1.8}\ t^{0.7} \quad \ldots\ldots\ldots (33)$$

or the difference in the torque due to the chisel point when operating on steel is about 1 per cent.

The values deduced from equations (37) and (38) for each size of drill are given in column d of Table IX.

Thrust.

It was to be expected that the removal of a piece in the specimen equal to the chisel point width would produce a greater difference in the end-thrust than in the torque. The results of these tests have been plotted in Fig. 17 and Fig. 19 on a base of feed per revolution for cast iron and steel respectively.

The lines drawn on these figures for the thrust correspond to the equations given in column b of Table IX. As in the previous cases the index of t varies very little and a constant value of 0.6 has been taken, which is about the mean of those obtained. The coefficient of t has also been altered to suit this modification and these equations are given in column c. Using the values of the latter a general equation as a function of d and t is got and the values deduced from it for each size of drill are given in column d of Table IX. Thus for soft cast iron:

$$P_o = 12{,}600\ d^{0.7}\ t^{0.6} \quad \ldots\ldots\ldots (39)$$

Comparing the latter with the ordinary trials (e) on this material there is a difference in the end force for feeds commonly used in practice of about 25 per cent, which is roughly that due to the chisel point.

The thrust for medium steel in this set of trials is as follows:

$$P_o = 27{,}000\ d^{0.73}\ t^{0.6} \quad \ldots\ldots\ldots (40)$$

and in the ordinary trials (f) the thrust was

$$P_o = 35{,}500\ d^{0.7}\ t^{0.6} \quad \ldots\ldots\ldots (36)$$

The thrust due to the chisel point in this case is about 21 per cent of the whole drill.

Experiments Series (i)—The Variation of Torque and Thrust When Drilling Different Grades of Cast Iron.

The torque and thrust obtained in these tests with a 2-inch drill have been plotted as ordinates on a base of feed per revolution of drill on Figs. 20 and 21. The hard cast iron trials were not so satisfactory as the others, owing to the presence of very hard spots in the specimen. These quickly destroyed the cutting edge and chisel point, so that it was impossible to get a complete set of trials without regrinding the drill. The lower spots indicate the results obtained with a freshly ground drill for each test. On the whole these experiments show that the torque and thrust increase very rapidly with the percentage of combined carbon.

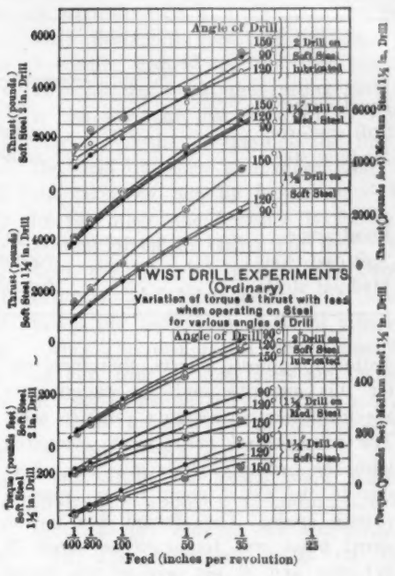

TWIST DRILL EXPERIMENTS
(Ordinary)
Variation of torque & thrust with feed when operating on Steel for various angles of Drill
Angle of Drill
Feed (inches per revolution)

FIG. 23.

Experiments (j) and (k)—The Variation of Torque and Thrust When Drilling Steel of Different Grades Without and With Lubricant.

These trials were made with a 2-inch drill and the results have been plotted on Figs. 20 and 21 after the manner of those already described. To avoid confusion with the spots and also to allow of an easy comparison between the dry and lubricated tests, separate vertical scales are used for each material, but the horizontal scale is common to all. With the exception of the tests on hard cast iron already mentioned and the hard steel, these trials were made under identical conditions to those previously discussed, viz.: a fresh drill was used for the 1/490 feed and the other trials made in the order of increased feed without regrinding the drill. In the case of the tests on hard steel it was impossible to get a complete set under these conditions owing to the blunting of the chisel point, and the results shown in the diagram were obtained with a freshly ground drill for each experiment. It will be observed that there is little difference between the torque and thrust for the soft and medium steel. This is, no doubt, due to the high percentage of manganese in the former. Roughly speaking the torque and thrust are practically proportional to the carbon plus the manganese for any given feed.

Lubricated Tests.

In order that an estimate of the effect due to lubrication may be made the values given in column two and four of Table X have been modified to suit a constant index of the feed. These approximations are shown by the dotted lines in the figures and the corresponding values are given in columns three and five of Table X. The lubricant used was Beckett's turning oil mixed with water in the proportion of one to fifty.

TABLE X.—*Equations to Lines on Figs. 20 and 21.*

1	2	3	4	5
Material.	Torque. (Fig. 20).		Thrust. (Fig. 21).	
	Full lines.	Dotted lines.	Full lines.	Dotted lines.
Soft cast-iron (dry)	$2600t^{0.7}$	—	$53900t^{0.75}$	—
Medium cast-iron (dry)	$2700t^{0.7}$	—	$45000t^{0.69}$	$57000t^{0.75}$
Hard cast-iron (dry)	$290t^{0.71}+50$	—	$45500t^{0.74}+1500$	—
Soft steel (dry)	$4840t^{0.7}$	—	$50060t^{0.6}$	—
Soft steel (lubricated)	$6100t^{0.785}$	$4140t^{0}$	$36260t^{0.6}$	—
Medium steel (dry)	$5250t^{0.7}$	—	$54000t^{0.7}$	—
Medium steel (lubricated)	$9000t^{0.89}$	$3830t^{0}$	$54500t^{0.6}$	$36000t^{0.6}$
Hard steel (dry)	$17250+30$	—	$55000t^{0.6}$	—
Hard steel (lubricated)	$16750+15$	—	$48980t^{0.6}$	—

Torque.

An examination of the results themselves show that the percentage decrease in the torque due to lubrication is almost the same in soft and hard steel; also that this decrease is most conspicuous with the finer feeds. The average torque for each feed in these trials varies from 72 per cent with the 1/400 feed to 92 per cent with the 1/35 feed of that obtained when operating dry.

Thrust.

The thrust for soft, medium and hard steel is 26 per cent, 37 per cent and 12 per cent, respectively, less than that ob-

tained when operating dry. There is no marked difference in any case with these percentages and the feed as in the torque.

Experiments Series (l) and (m)—The Variation of Torque and Thrust With Angle of Drill Point When Operating on Cast Iron and Steel.

In this set of trials the included angle θ only was altered; the pitch, chisel point, etc. (see Fig. 4), remaining as in previous tests and given in Table III. The results obtained have been plotted on Figs. 22 and 23 and full lines are drawn through the mean of the spots for each set. Equations to the strong full lines for the 1½-inch drill only have been attempted and these are given in Table XI. With the exception of the thrust on cast iron the characters are generally alike.

TABLE XI.*Equations to Full Lines on Figs. 22 and 23 for 1½-inch Drill.*

	Torque.		
Point angle	90°	120°	150°
Soft cast-iron	$1980t^{0.7}$	$1600t^{0.7}$	$1380t^{0.7}$
Medium steel	$4170t^{0.7}$	$3400t^{0.7}$	$2780t^{0.7}$
	Thrust.		
Point angle	90°	120°	150°
Soft cast-iron	$79000t + 250$	$100000t + 250$	$127000t + 250$
Medium steel	$64700t^{0.7}$	$66800t^{0.7}$	$69700^{0.7}$

Torque.

From the statement already made a variation in the torque due to an alteration of the point angle would be expected since it also alters the plane in which the shavings leave the work; i. e., the true cutting angle. The mean cutting angles for these drills are given in Table XII. Since the cutting pressure is proportional to the cutting angle, the torque for a given diameter of drill and feed is also proportional to it. By dividing the coefficient of t in Table XII by the cutting angle the quotient should be a constant. This, however, is not the case (see lines 6 and 7, Table XII), and the variable quotient can only be attributed to a bluntness effect which is proportional to the length of the cutting lip. The lengh of the lips are equal to $\frac{d - \text{chisel point}}{\cos\ 90 - \frac{\theta}{2}}$ and are given in line five of Table XII, from which it will be seen that they are in the order of the quotients above. Messrs. Bird and Fairfield found no marked difference in the torque due to the alteration of the point angle.

Thrust.

It will be noticed that the values for the thrust are in the order of the included angle and exactly the reverse of those for the torque. That the drill having the keenest cutting angle should give the greatest backward thrust may appear at first glance to conflict with the results obtained in the "Experiments With a Lathe-Tool Dynamometer" and common experience. It must be remembered, however, that the drill having the least lip angle has also the greatest adverse chisel point angle. Two distinctly opposite effects, therefore, enter this quantity, and the experiments are insufficient to assign a value to each. The minus-chisel point when compared with the ordinary trials give the effect due to the chisel point for a common cutting angle. The amount due to the chisel point was found to be about 25 per cent and 21 per cent of the thrust for the whole drill in cast iron and steel respectively, while the chisel point is barely 10 per cent of the drill diameter. For drills with included angles other than 120 degrees it is reasonable to suppose that the value due to the chisel point should vary as $\sin \frac{\theta}{2}$, i. e., $\cos \beta$. It would be expected that if the quantity thus derived is subtracted from the total thrust the remainder should be a value decreasing somewhat with the cutting angle of the lip. This answers fairly well with the steel trials (see line 11, Table XII), but is very far out with the results obtained in the cast iron tests.

Owing to the results of the steel test coming so closely together, they were repeated. The drill used in the latter set was soft at the point and the 90 degrees tests fell on the top of the 120 degrees, owing to the former blunting at the point. A set with the 2-inch drill was therefore made and a strong stream of lubricant was used to give the 90 degrees drill every chance of standing up to the work.

The results obtained in the tests on cast iron have also been plotted on a base of point angle at the left-hand corner of Fig. 22. Messrs. Bird and Fairfield's experiments with a ⅝-inch drill are also shown. These agree very closely with results given herein.

Conclusions—First Set of Tests.

(a) The horsepower for a given diameter of drill and feed is proportional to the revolutions or the cutting speed.

(b) The horsepower $\left(\frac{2\pi NT}{33000}\right)$ proportional to the torque, and for a given drill and speed does not increase as fast as the feed [see equations (4) and (9)].

(c) Since the torque is practically proportional to the square of the drill diameter the horsepower, for a given feed and cutting speed, is directly proportional to the diameter of the drill [see equations (4) and (9)].

(d) The horsepower per cubic inch of metal removed is inversely pro-

TABLE XII.

(1) Point angle	90°	120°	150°
(2) Cutting angle of lip and backed off portion	89.2	72.8	65.5
(3) Cutting angle of chisel point	13.0	14.4	15.8
(4) Cutting angle (total)	102.2	87.2	81.3
(5) Length of lip and backed off portion	$\frac{0.804 \times 0.75}{0.707} = 0.86$	$\frac{0.804 \times 0.75}{0.866} = 0.782$	$\frac{0.804 \times 0.75}{0.906} = 0.71$
(6) Coefficient of t for torque in cast-iron—Total cutting angle	$\frac{1980}{102.2} = 41$	$\frac{1540}{87.2} = 17.7$	$\frac{1380}{81.3} = 17$
(7) Coefficient of t for torque in steel—Total cutting angle	$\frac{4170}{102.2} = 41$	$\frac{3400}{87.2} = 39$	$\frac{2780}{81.3} = 34.2$
(8) Cosine β	0.707	0.866	0.966
(9) Coefficient of t for thrust in steel	64700	66800	69700
(10) Thrust due to chisel point $= \frac{21 \times 66800 \times \text{Cos } \beta}{100 \times \text{Cos } 30}$	11450	14000	15800
(11) Thrust due to the lip = (9)-(10)	53250	52800	53900

portional to the feed and independent of the drill and cutting speed [see equations (4) and (9)].

(e) The work required to drill a given hole, when one drill only is used, is greater than that required to drill the same hole in two operations with drills of different diameters. The greater the difference in the drill diameters, the greater the saving in work; speed and feed remaining the same throughout. This is due to the fact that the mean cutting angle of the single drill is greater than the average angle in use for the two drills and that the stress is proportional to the angle [see equations (10), (11) and (12)].

(f) With twist-drills having the usual proportions (similar to those given in Table I.), the cutting angle is not sufficiently keen to drag the drill into the work when enlarging a hole in cast iron or steel [see equations (13) to (15) and (18a) to (18c)].

Conclusions—Second Set of Tests.

(g) Conclusion (b) confirmed. The horsepower when operating on soft cast iron or medium steel varies as $t^{0.7}$ for a given drill and speed [see equations (21) and (33)].

(h) The horsepower for a given feed and speed does not increase as fast as the diameter but varies as $d^{0.8}$ [see equations (21) and (33)].

(i) The torque and horsepower when drilling medium steel is about 2.1 times that required to drill soft cast iron with the same drill speed and feed.

(j) The horsepower per cubic inch of metal removed is inversely proportional to $d^{0.2}$ $t^{0.3}$ and independent of the revolution. Thus the horsepower per cubic inch of metal $= \frac{4\times 2\pi Nc\, d^{1.8} t^{0.7}}{33000\pi d^2 tN} = \frac{k}{d^{0.2} t^{0.3}}$ where c and k are constants.

If d remains constant and feeds of 1/400 inch, 1/100 inch and 1/25 inch be taken, the corresponding horsepowers will be in the order of 1,0.66 and 0.435. If t remains constant and values of $d=$ ½ inch, 2 inch and 4 inch be taken, then the horsepower for each successive drill will be in the order of 1,0.76 and 0.66.

(k) The power required to enlarge a hole may be estimated from the pressures given by equation (25a) for cast iron, and 2.1 times that value for medium steel.

(l) In a two-lipped drill the actual depth of cut taken by each lip is $\frac{t}{2}$; in a three-lipped drill $\frac{t}{3}$; and so on. If the number of lips is increased, and t kept the same, the pressure produced is equivalent to that for a proportionately decreased feed. If the lips are unequally ground, so that the one lip does all the work, the cutting pressure is the same as that obtained by doubling the feed. By gashing the lips of the drill in such a manner that the cut taken by one lip is the metal left by the other, the pressure is the same as that given for twice the feed. The finer the feed the greater the cutting pressure and consequently the horsepower per cubic inch of metal removed.

(m) The end thrust when operating on cast iron or steel does not increase in proportion to the feed for a given diameter of drill or in proportion to the diameter for a given feed.

(n) Whilst the chisel point scarcely affects the torque it is accountable for about 20 per cent of the end-thrust.

(o) The lubricated trials on steel when compared with the dry tests show a diminution in the torque and horsepower, varying from 28 per cent with the 1/400 feed to 8 per cent with the 1/35 feed. This may be due to the lubricant washing away the small metal chips which tend to jam between the walls of the hole, and the drill, and to the preserved cutting edge. The diminished frictional resistance of the shaving across the lip together with above reduces the end-thrust by about 25 per cent for all feeds.

(p) The drill most commonly adopted in practice has an included angle at the point of 120 degrees. If this angle is increased, the torque diminishes, but the end-thrust increases, while if this angle is decreased, the reverse is the result. So far as economy in power is concerned the torque is the factor to consider, as the feeding horsepower is only about 1 per cent of the whole in small drills and very much less for the larger sizes (see Tables VII. and VIII.). From this point of view the drill with the larger point angle is to be preferred. The accompanying increased end-thrust, however, strains the machine parts in proportion. When the point of the drill breaks through the metal at the bottom of the hole, a considerable portion of the end load is removed. The strain due to that load is released, thereby causing the drill to advance more than its rated feed and possibly break the drill. The drill with the greater included angle will be most likely to give trouble in this direction, both on account of the increased strain and torque and conversely.

(q) By decreasing the spiral of the drill a keener cutting angle with a decreased end-thrust and torque can be obtained without altering the point angle above the accepted standard (120 degrees). This, however, would in turn affect the durability of the drill. (See "Experiments With a Lathe-Tool Dynamometer."[1])

(r) With a small included point angle there is little metal to support the cutting edge at the chisel point and trouble due to blunting of this part is to be expected.

(s) In estimating the time required to drill a hole of given depth the length of the drill point must be taken into account. The length of the point for different included point angles is:

90 degrees = 0.5d
120 degrees = 0.29d
150 degrees = 0.134d

[1]Proceedings Inst. Mech. Engineers, 1904, Part 3, page 883.

CUSTOMS DECISIONS.

The Board of United States general appraisers decided as follows:

That circular steel disks measuring 16 inches in diameter and 0.078 inch in thickness imported by Hermann Boker & Co., New York, are dutiable at 1.3 cents per pound under paragraph 135 of the present tariff plus ½ cent per pound under paragraph 141. The disks were imported to be used as the ends of spools on which wire is to be wound, but the board and the circuit court held that the goods are "circular saw plates" since they *may* be used as such. The issue was whether the extra ½ cent per pound was taxable.

Davies, Turner & Co., of Boston protested against the assessment by the collector of 2¼ cents per pound under paragraph 161 on cut nails of steel. They claimed the duty should have been at 6-10ths cents per pound under paragraph 160. Their claim was sustained.

Will Sell Direct.—Announcement is made by the Pittsburg Coal Co. that the arrangement whereby B. Nicoll & Co. have served as its Eastern selling representatives has been terminated. Louis H. Washburn, heretofore connected with the coal department of B. Nicoll & Co., has been appointed eastern sales agent for the Pittsburg company, with offices at 2 Rector street, New York City, and the company's products will be sold direct in this district. This includes the output of the Colonial coke ovens. J. W. McQueen, who has been associated with the Blaine Coal Co., has become connected with the coal department of B. Nicoll & Co.

More New High Price Records.

Monday the market ruled dull, and the close was reactionary; the grain markets were firmer and cotton also advanced; a receiver was appointed for a New York exchange house with Chicago connections, which failed for over $1,000,000. Activity distinguished Tuesday's market until the final hour, when the whole list advanced and closed strong with Steel common as a leader; the weekly government report was rather unfavorable for the growing crops. The unexpected death of Henry H. Rogers, president of the Amalgamated Copper Co., and vice president of the Standard Oil Co., caused a slight check to the market Wednesday at the opening, but the entire list finally rallied and closed firm; Steel common advanced to 59¾, the highest point ever quoted, and Crucible Steel preferred also to the highest price since 1907. Thursday various industrial and railroad stocks advanced to the highest prices ever quoted and upon a sharp reaction following, all the earlier gains were wiped out; the Bank of England rate was unchanged at 2½ per cent; copper metal advanced ⅛ cent in New York and closed higher in London. Steel common made a new high record of 60¼ Friday, but trading became dull later and closed irregular; grain prices were strong and cotton prices higher. Saturday the market was active and strong, and Steel common advanced to 60⅜; both May wheat and cotton were firm.

Call money ranged between 2 per cent and 1½ per cent, averaging 1¾. There was a rather limited demand for time money and a large supply. Gold exports had no influence whatever on the money market, although the gold export engagements for the week were between $6,000,000 and $7,000,000. The surplus reserve increased $5,301,850, bringing the total surplus up to $20,523,000, compared with $64,153,700 a year ago, and $23,606,100 two years ago in corresponding weeks. The report of the actual conditions of clearing house banks showed loans increased $7,049,100; deposits increased $6,446,800; the surplus increased $1,424,900; and the percentage of actual reserve, 26.64, an increase of 0.11 per cent. State banks and trust companies showed loans decreased $2,887,800, net deposits decreased $679,600, and the percentage of reserve 18.8, unchanged. Bank clearings throughout the United States showed a decline of 6 per cent, compared with the preceding week.

THE LEADING INDUSTRIAL SECURITIES.

	Closing Quo. May 22	Changes in Week	Date Ann.	1909 M't'g.	Stock Outstanding	Dividend Basis	Dividend Last Declared	Dividend Date Last Div. Pay.
Allis-Chalmers	16¼	+ ⅜	Sept.	2	$19,820,000		.....	.....
Allis-Chalmers, pr	51⅜	+ ½			16,150,000	7 cum	1¾ Q.	Feb., 1904
American Can	13⅛	— ⅛	Feb.	2	41,233,300		.....	.....
American Can, pr	82	.....			41,233,300	7 cum	1¾ Q.	Jan., 1909
Am. Car & Foundry	55	+ ⅜	June	24	30,000,000		½ Q.	Jan., 1909
Am. Car & Fdy., pr	116⅛	+ ⅛			30,000,000	7 n. c.	1¾ Q.	Jan., 1909
American Loc	57⅜	— ⅛	Oct.	19	25,000,000	5	1¼ Q.	Aug., 1908
American Loc., pr	115	— ⅜			25,000,000	7 cum	1¾ Q.	April, 1909
American Ship	60	+5⅝	Oct.	13	7,600,000	4	1 Q.	June, 1908
American Ship, pr	108	+3½			7,900,000	7 n. c.	1¾ Q.	Oct., 1908
Am. Steel Foundries (new)	39½	.....	Dec.	2	17,184,000		.....	.....
Am. Steel Foundries, pr	47½	.....			17,240,000	6 cum	1	Aug., 1904
Barney & Smith	30	—3	June	1	2,000,000	4	1 Q.	Sept., 1907
Barney & Smith, pr	95	.....			2,500,000	8 cum	2 Q.	June, 1908
Bethlehem Steel	29¼	+2¾	April	6	14,862,000		.....	.....
Bethlehem Steel, pr	59	+4			14,908,000	7 n. c.	¾ Q.	Feb., 1907
Cambria Steel	39	+1¼	March	16	45,000,000*	3	1½ S. A.	Feb., 1909
Cambria Iron	46⅛	.....			8,468,000*	4	2 S. A.	Sept., 1908
Chicago Pneumatic Tool	24¼	+2¼	Feb.	15	6,145,800	4	1 Q.	Oct., 1907
Colorado Fuel	41¼	+ ⅜	Oct.	18	34,235,500		3½	April, 1902
Crucible Steel	9	— ¼	Oct.	20	24,578,400		.....	.....
Crucible Steel, pr	67¾	— ¼			24,436,500	7 cum	1 Q.	Mar., 1909
Empire Steel	6	—1	April	27	1,254,770		.....	.....
Empire Steel, pr	51	+1			2,500,000	6 cum	1½ S. A.	Jan., 1909
Fay & Egan	90	.....	Feb.	18	1,000,000	7	1¾ Q.	Nov., 1908
Fay & Egan, pr	125	.....			1,000,000	7 cum	1½ Q.	May, 1909
General Electric	160½	+1¼	May	11	65,178,800	8	2 Q.	Jan., 1909
Harbison-Walker	17	.....	Jan.	18	18,000,000		½	Oct., 1907
Harbison-Walker, pr	85	+ 3			9,600,000	6 cum	1½ Q.	April, 1909
International Pump	40½	— ⅜	June	8	17,762,500		1	April, 1905
International Pump, pr	87¾	— ¼			11,350,000	6 cum	1½ Q.	May, 1909
Lackawanna Steel	43	.....	March	10	34,971,400		.....	.....
Lake Sup. Corp	31¼	+ ⅛	Oct.	6	40,000,000		.....	.....
New York Air Brake	88¾	+1¾	June	17	8,012,500	8	2 Q.	Oct., 1907
Niles-Bement-Pond	100	.....	Feb.	3	8,500,000	3	1½ Q.	June, 1909
Niles-Bement-Pond, pr	100	.....			2,000,000	6 cum	1½ Q.	May, 1909
Otis Elevator Co	55	+4	March	15	6,375,300		1½ S. A.	April, 1909
Otis Elevator Co., pr	97	.....			6,295,000	3 n. c.	1½ Q.	April, 1909
Penn Steel	50	.....	May	10	10,750,000		.....	.....
Penn. Steel, pr	105	.....			16,500,000	7 n. c.	3½ S. A.	May, 1909
Pittsburg Coal Co	11½	— ½	March	9	28,104,600		.....	Nov., 1906
Pittsburg Coal Co., pr	47½	+1½			27,071,800	7 c.	1¾	April, 1905
Pressed Steel Car	42	+ ½	Feb.	17	12,500,000		3	Aug., 1904
Pressed Steel Car, pr	103	.....			12,500,000	7 n. c.	1¾ Q.	May, 1909
Pullman	191⅛	+3⅜	Nov.	10	100,000,000	8	2 Q.	May, 1909
Railway Stl. Spring	43	— ¾	March	4	13,500,000	2	1 S. A.	Oct., 1908
Railway Stl. Spring, pr	106	.....			13,500,000	7 cum	1¾ Q.	Dec., 1908
Rep. Iron & Steel	28¾	+2¼	Oct.	20	27,191,000		.....	.....
Rep. Iron & Steel, pr	91	+4⅛			20,416,900	7 cum	1¾ Q.	April, 1908
Sloss-Sheffield	83	+3	March	10	10,000,000	5	1¼ Q.	June, 1909
Sloss-Sheffield, pr	113	.....			6,700,000	7 n. c.	1¾ Q.	April, 1909
U. S. Pipe & Fdy	33¾	.....	June	23	12,500,000	2	½ Q.	Dec., 1907
U. S. Pipe & Fdy, pr	78	— ¾			12,500,000	7 n. c.	1¾ Q.	Sept., 1908
U. S. Steel	60¼	+3⅝	April	19	508,302,500	2 n. c.	½ Q.	June, 1909
U. S. Steel, pr	120	+1¼			360,281,100	7 cum	1¾ Q.	June, 1909
U. S. Steel, 5s	104⅝	+ ¼			463,798,000	5	5 A.	.....
Va. Iron, Coal & Coke	63	— ⅛	Sept.	21	9,073,680		.....	.....
Westinghouse Elec	84	+ ⅜	June	16	27,173,200	10	2½ Q.	April, 1909
Westinghouse Air Brake	110	+ ½	Oct.	5	14,000,000*		2½ Q.	Oct., 1907

Par value of shares, $100, except those starred (*), $50.

For the two weeks ending May 12, there was an increase in the number of idle freight cars of 2,461.

Commercial failures for the week were 238, compared with 234 the preceding week, and 236 the corresponding week last year. Shares were dealt in to the number of 3,004,610, compared with 4,660,640 the preceding week, and 6,678,312 the corresponding week last year. Bonds, exclusive of government bonds, were sold to the amount of $20,626,000, compared with $31,726,000 the preceding week, and $23,528,000 the corresponding week last year.

Copper Stocks.

New York.—Amalgamated Copper closed 84⅛, a net gain of ⅞.

Boston.—Butte Coalition closed 26, a net gain of ¼; Calumet & Arizona closed 102¾, a net loss of ¾; Calumet & Hecla closed 640, a net loss of 10; North Butte Mining closed 56⅛, a net loss of 5⅜; Quincy Mining closed 92, a net gain of 1.

Financial Notes.

The Inland Steel Co. declared the quarterly dividend of 1¾ per cent; the General Electric Co., the regular quarterly dividend of $2 per share, payable July 15; Calumet & Hecla Mining Co., a dividend of $6 per share, payable June 22, an increase of $1 per share over a year ago; North Butte Mining Co. declared a quarterly dividend of $1 per share, payable June 26; the Railway Steel Spring Co., the regular quarterly dividend of 1¾ per cent on preferred, payable June 21; Quincy Mining Co., the regular quarterly dividend of $1 per share, payable June 21; Calumet & Arizona Mining Co., the usual quarterly dividend of $1 per share.

NEWS FROM MANY INDUSTRIES

New Buyers:—

Louis H. Grau, Frederick Hartman and William H. Grau Jr., have applied for a charter as the Grau-Hartman Tool Co., Milwaukee, with $2,500 capital stock.

The Lawrence Steel Tank & Boiler Co., Marietta, O., has been incorporated with $10,000 capital stock by F. B. Ranger, C. S. Bunch, J. Howard Day, J. L. Peters and Arthur Dow.

The Lange Mfg. Co., Milwaukee, Wis., has filed articles of incorporation with $20,000 capital stock. The incorporators are: Arthur Lange, Emil Dietrich, Oscar Lange and George Dietrich.

The Steel Reesor Co., Ltd., has been incorporated by Jesse Reesor, Christopher W. Steel, Robert J. Mann and others, with $60,000 capital stock, to do a foundry and machine shop business at Toronto, Can.

The National Coning Machine Co., Indianapolis, Ind., has been incorporated with $1,000,000 capital stock, for the manufacture and sale of machinery for making paper bottles. The directors are William A. Scott, Alfred C. Wood and Murat W. Hopkins.

The Plumbing & Engineering Supply Co., Ltd., of Fort William, Ont., with an authorized capital of $200,000, has been incorporated with Alexander Cameron, John Marshall, A. C. Walz, E. D. Higginbottom and John McRae as provisional directors.

The Crescent Iron Co., New York city, oil, gas, coke, ore and charcoal, with $250,000 capital stock, has been incorporated by H. R. Woodward and Herman Baruch, 97 Cedar street, and Robert H. Jones, 10 Wall street, all of New York City.

Martin J. Quinn, Robert J. Cliff, Thomas Southworth and others have incorporated as the National Equipment Co., Ltd., to manufacture heating and plumbing systems and carry on general contracting business at Toronto, with $40,000 capital.

A certificate of incorporation has been granted to the Standard Brass & Copper Tube Co., of New London, Conn., which has the following directors: William M. Parke and Roger J. Heisler, of New York City, and Frederick J. Loomis, of New London, Conn. The company's capital is $6,250.

The Mechanic Heating & Construction Co., St. Louis, Mo., has been chartered to install heating and power plants and to do a general construction business. The capital stock, fully paid, is $10,000, and the incorporators include Margaret Atwood, Henry C. Brammeier and Edward Harrihill.

Leonard Keil, New York city, has been granted a charter to deal in machinery, safes, engines and boilers, with a capital of $2,000. The incorporators are: Leonard Keil, 318 Sixth street, West New York, N. J.; George Deulerman, 4716 Richardson avenue, New York city, and Winifred E. Keil.

The Albany Malleable Iron Co., Albany, N. Y., malleable iron castings and hardware, with a capital of $150,000, has filed articles of incorporation. Those interested are William E. Woollard, Albany, N. Y.; Frederic V. Griesman, Voorheesville, N. Y., and George L. French, Troy, N. Y.

The Phoenix Brass & Metal Co., New York City, has been incorporated to manufacture steam, water apparatus, valves, etc., with a capital stock of $10,000. Those interested are: Edward Gunnell, 210 Waverly place, Stephen McFarland, 44 Morton street, and Patrick J. O'Brien, 44 Charlton street, all of New York City.

Harris H. Uris Iron Works, New York City, manufacturing structural and ornamental iron and steel and metal work, with $25,000 capital stock, has these incorporators: Harris H. Uris, 120 East Ninety-third street; Abraham Uris, 27 West 111th street; Morris Uris, 18 East 107th street, all of New York City.

The General Iron Works, Brooklyn, N. Y., has been granted a certificate of incorporation to manufacture iron and steel into beams, piers, columns, etc., with a capital of $5,000. The incorporators are Max Cohen, 39 Osborn street; Sarah Weschler, 1600 East Parkway, Brooklyn, N. Y., George Bader, 75 East Seventh street, New York city.

The Newcomb Engine Co., Harrison, Westchester county, N. Y., has made application for a charter to manufacture motors, engines, automobiles, launches, etc. Those interested are William B. Thompson, 22 Lewis street, Union Course, L. I., N. Y.; Otto A. Hack, 31 Nassau street; Edwin C. Chamberlain; 4 West Eighty-fourth street, both of New York City.

New Construction:—

The Emerson Steam Pump Co., Alexandria, Va., is having plans prepared by Dodge & Day, 608 Chestnut street, Philadelphia, for a new plant that will probably cost $50,000.

The Reeves Mfg. Co., Muskogee, Okla., which operates a foundry and machine shop, has purchased four lots, upon which it will erect a large brick building, in which to house the plant.

The A. E. Shorthill Co., Marshalltown, Ia., gray iron founder, is planning to remove to Waterloo, Ia., with the intention of locating upon a site not definitely decided upon, but in the factory district of West Waterloo.

The Michigan Crucible Steel Castings Co., of Detroit, which recently purchased a factory site at the northwest corner of Mount Elliott and Milwaukee avenues, is planning to build there an extensive plant when the present foundry on Guoin street will be discontinued. The new site comprises 5½ acres.

The Automatic Roller Bearing Co., which is removing its plant to Goshen, Ind., is arranging to occupy the Riley building on South Ninth street until its new machine shop is ready for occupancy, ground for which is being broken. Construction on the new plant will be pushed forward as rapidly as possible.

The Dempster Milling & Mfg. Co., Beatrice, Neb., has announced, through President C. B. Dempster, that it will shortly begin the construction of an addition to the foundry and also the erection of another structure to be used for the manufacture of steel tanks. Both buildings will be of brick and concrete, the foundry addition to be 80 x 100 feet, and the tank building, 65 x 150 feet, three stories.

The Sterling Machine Works, Sterling, Ill., is planning to increase its capital stock from $50,000 to $200,000, and also to erect a plant large enough to accommodate increased business. Options have been secured on several tracts of land. The company has closed a proposition with William R. Everett, of Chicago, inventor of mechanical parts of an automobile, which the company proposes to place upon the market.

The Iowa Central Railway Co. expects to complete an addition to its machine shops at Marshalltown, Ia., shortly, 22 x 160 feet, when the installation of new shop tools and power equipment, including boilers, and stationary engine, will be started. Master Mechanic Gossett is quoted as saying that this additional shop equipment is imperative, but does not mean that Marshalltown will be the permanent location of the company's general shops.

The Southern Railway Co. has awarded the general contract to David Getaz & Son Co., of Knoxville, Tenn., for the erection of a boiler shop at Coster,

Tenn., to cost approximately $250,000. The new building will run at right angles with the new machine shop just completed, 102 x 332 feet. A riveting tower will be a feature of the building, 30 feet square and 50 feet high. The building will be of brick and steel construction, with tar roof.

The Speedwell Motor Car Co., Dayton, O., from Jan. 1 to July 1, 1908, has erected nine additional buildings which have nearly covered the three acres of ground owned by it. Finding even these buildings inadequate, the company has purchased three additional acres and now has in course of construction other large buildings, which will add several hundred thousand feet of floor space. A spur track from the Big Four lines will be extended past its new buildings, from which all carload shipments will be made. The company expects during the season of 1909-1910 that it will employ from 1,200 to 1,500 hands.

General Industrial Notes:—

The Radel Sash Balance & Lock Co., Cincinnati, has reduced its capital stock from $200,000 to $50,000.

The Crown Mfg. Co., Cincinnati, advises respecting its recent fire that it sustained simply a slight damage from water.

The Strubler Computing Scale Co., Elkhart, Ind., has filed a notice of its increase of capital stock from $50,000 to $100,000.

The Waukesha Motor Co., Waukesha, Wis., has increased its capital stock from $25,000 to $100,000, and the number of its directors from three to five.

The Noelke-Richards Iron Works, Indianapolis, has been granted a permit to do business in the state of Texas, its principal office to be at Forth Worth.

The foundry and machine shop of William Wright, Waukegan, Ill., will be sold to the Twentieth Century Machine Co., which will take possession shortly.

The Crowell Machine Co., Boston, the incorporation of which was recently noted, advises that it holds certain patents, and that for the present at least will not engage in manufacturing.

The Dudley Adding & Billing Machine Co., which has been located for several years at Staunton, Va., is removing its machinery to Baltimore, where it will establish a larger manufactory.

The Standard Nipple & Tool Co., West Newton, Pa, has been organized with a capital stock of $100,000, to take over the plant of the former Standard Stove & Range Co. The Standard company has been operating in Pittsburg for several years. Machinery will be installed in the new location and repairs made. Among the directors which attended the meeting at which this decision was reached were W. A. Lautsberger, Frederick Clifford, R. H. Stevenson, W. W. L. Goehring, W. Newton, F. M. Mechling, G. C. and J. L. Blackstone, of Pittsburg.

The H. G. Blumenthal Co., Provo, Utah, which has been incorporated with a capital stock of $25,000 to manufacture and sell sheet metal, galvanized iron, etc., has these officers and directors: President, H. L. Bloomenthal; vice president, Samuel H. Adams; secretary and treasurer, Arthur Salt; Seymour H. Adams, Daniel S. Kirkwood and Henry P. Taylor, directors.

The Freeport Windmill & Gas Engine Co., Freeport, Ill., whose recent incorporation was noted in THE IRON TRADE REVIEW, advises that the foundry and buildings have been erected, and the equipment purchased. The company will manufacture wind mills and gasoline engines, besides doing general jobbing work in light and heavy gray iron castings. The president of the company is O. J. Ziegler, who was superintendent of the Stover Mfg. Co. for more than 25 years. Paul F. Schryer, formerly vice president and superintendent of the Stover Works, will be associated with the Freeport company, as well as Roy M. Bennethun as secretary. Carl Schwartz will be in charge of the foundry, Edward Mensenkamp in charge of the pattern making, and Fred L. Kobow the stock and shipping departments. They are all practical men of long experience.

The Davis Mfg. Co., Milwaukee, Wis., advises respecting its recently noted increase of capital stock from $50,000 to $100,000, that this has been done simply to keep pace with the increase in the company's business. Last fall, a new shop, 100 x 150 feet, of brick and concrete, with steel roof trusses, was constructed. Sufficient property has also been purchased by the company, so that it will be able to add shops which will increase its floor space to three times the present amount. It advises further that it is not in the market for additional equipment at the present time, but is adding new tools as it needs them. Its principal business is the building of automobile and gasoline engines, the bulk of the business being in the automobile line, but it also manufactures micrometer calipers of large size, on which the president of the company has a patent, and it also does considerable work in the way of sheet steel bins and shelving.

Trade Notes:—

The Atlas Engine Works, Indianapolis, builder of steam engines and boilers, has removed its Chicago offices from 900 Fisher building to 1645 Old Colony building.

The business of the Arthur D. Little laboratories, 93 Broad street, Boston, has been incorporated under the title of Arthur D. Little, Inc., in order that the facilities of the laboratory may be further extended and that permanency may be secured for the organization.

Price, Waterhouse & Co., chartered accountants, and Dickinson, Wilmot & Sterrett, certified public accountants, announce the removal of their Chicago offices from the Tribune building to 206 La Salle street, the Corn Exchange Bank building. They also announce that they have established a branch at 60 State street, Boston, under the management of J. Edward Masters, who has been associated with these companies for many years.

The C. O. Bartlett & Snow Co., Cleveland, engineer and manufacturer of elevating and conveying machinery, dryers, etc., announces that it has established an office at 50 Church street, New York City, in charge of H. H. Bighouse, chief engineer, which is prepared to give close attention to all matters pertaining to the elevating, conveying and economical handling of materials, as well as mechanical drying, etc.

Fires:—

The foundry of the Dundee Mfg. Co., Dundee, N. Y., was damaged by fire originating on the molding floor, May 15, the loss being estimated at $18,000.

The warehouse of the Somersworth Foundry Co., Salmon Falls, N. H., was seriously damaged May 12, several hundred cooking ranges and stoves being damaged by fire and water. The loss is estimated at about $8,000.

TRADE PUBLICATIONS.

ROCKER GRATES—The Patch rocker grate manufactured by S. B. Patch & Sons Co., Streator, Ill., is illustrated in a booklet, which describes its application to steam boilers and includes a list of users.

STEAM TURBINES—The Kerr steam turbine is one of the fairly well known type of small turbines, and its construction, application and economical performance is set forth in Bulletin No. 8 issued by the Kerr Turbine Co., Wellsville, New York.

SPUR GEAR REDUCERS.—The Foote Bros. Gear & Machine Co., 44 North Carpenter street, Chicago, is issuing a folder describing its spur gear reducer, which the makers say has been designed especially with a view of avoiding the shortcomings of other forms of gear reduction. The device is entirely enclosed, and externally very much resembles the enclosed type of electric motor. It is made in sizes up to 50 horsepower, with a reduction ratio from 8 to 1 up to 60 to 1.

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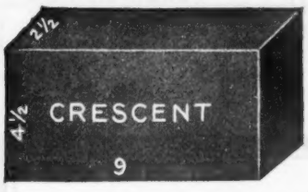

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EVERYWHERE:

Woodward iron, made at Woodward, Alabama, is one of the best known—and best—brands of Foundry Pig Iron.

Uniformity in castings is necessary to good results. Woodward is uniform, and may be depended upon to be so, year in and year out. This is due to uniform ore and fuel, and uniform furnace practice.

Woodward iron is remarkably low in Sulphur, and high in Total Carbon.

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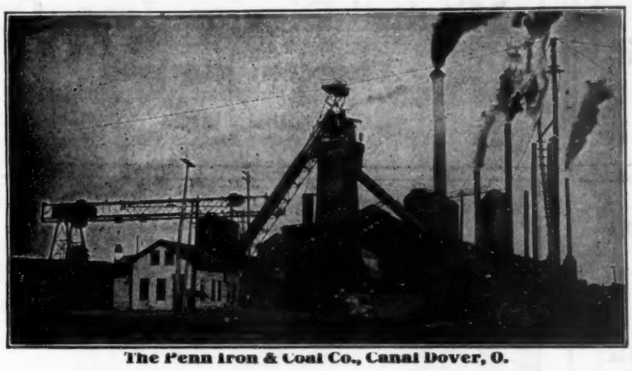
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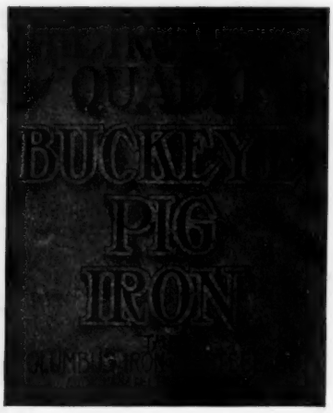

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Works at Sharon, Pa.

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It is no longer necessary to use inferior Fluor-Spar. Having now an annual capacity of 50,000 tons we are prepared to furnish promptly

GRAVEL—For Steel Mills, running 90% and up C-F and not over 4% Silica.

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GROUND—For Manufacturers of Hydro Fluoric Acid—Glass and Enamel Ware manufacturers, running 99% and up C-F and not over 0.50% Silica.

Prices are right. Let us send our Sales Manager to you. We want your contract.

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"JAMISON" SELECTED FOUNDRY COKE

Not how cheap, but HOW GOOD. We respectfully submit that this question is worth the Foundryman's most serious consideration, and a saving of 15 or 25 cents per ton on the Coke may mean a totally different result in the cost of your Castings.

Improvement is the order of the day with Jamison. 60 determinations from our shipments within the past two months showed this average, viz.:

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Our constant aim is to *Make Better Coke* regardless of cost. February, 1909, 72-Hour shipments of 19,000 tons, proves that our efforts are appreciated by our valued trade.

Won't you give us a chance to tell you more about this Coke?

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Offices: Lewis Block PITTSBURG, PA.
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CONNELLSVILLE COKE
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Mines and Ovens in Connellsville region.
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Lake Superior Charcoal Pig Iron
BRANDS
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MARQUETTE, MICHIGAN, EXCELSIOR, PINE LAKE.
Particularly adapted for the manufacture of Car Wheels, Cylinders, Malleables and all foundry Castings, where great strength is required.
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FOUNDED 1865 BY GEO. G. BLACKWELL

CHROME ORE. Blackwell's special Refractory quality for Furnace Linings.
MANGANESE ORE of every grade.
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FERRO-CHROME. 60-72% Cr., [illegible]% to 1% Carbon and any [illegible] up to 10%.
FERRO-TUNGSTEN 50-90%, TUNGSTEN METAL, 96-99%.
FERRO-TITANIUM, FERRO-BORON, FERRO-VANADIUM, 25 and 50%.
FERRO-SILICON, 25%, 50% and 75%. COPPER SILICON.
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We make any and EVERY ALLOY AND METAL REQUIRED.
We make a SPECIAL HIGH SPEED ALLOY FOR TOOL STEEL

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FOUNDRY COKE. *Efficiency* in Foundry Coke (yield of iron per ton of coke) and *Strength of Coke* are very important factors in using coke. Many cokes are low in sulphur, but on account of weak structure cannot produce high yield of iron per ton of coke. Washington 72 Hour Foundry Coke is low in sulphur and produces superior results in the cupola.

WASHINGTON CRUSHED COKE is the best.
LOW SULPHUR STOCK COKE for Heating.

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RECEIVER'S SALE

THE CAPITOL LOCK NUT & WASHER CO.

Notice is hereby given that on Saturday, the 29th of May, 1909, at 11 o'clock a. m., at the door of the Court House in the City of Columbus, O., Charles P. Outhwaite, as receiver of the Capitol Lock Nut & Washer Company, will offer for sale at public auction at not less than $45,000 all of the real estate, buildings, fixtures, office and shop furniture, supplies, engines, machines, machine tools, stock on hand finished and unfinished, tool steel, tools, dies and patents, being all of the property of the Capitol Lock Nut & Washer Company used in connection with its plant and business, saving and excepting the accounts receivable, money in bank and on hand, said property being appraised at $76,400.23 and the same will be offered for sale as a whole and for not less than $45,000.

The real estate above mentioned is described as follows: being a certain piece of ground situate in the County of Franklin, State of Ohio and in the City of Columbus, and being lots Nos. 48, 49, 50, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122 and 123 of Johnson's South Grove Addition to the City of Columbus, O., as the same are numbered and delineated on the recorded plat thereof of record in Plat Book No. 7, pages 166 and 167. Recorder's Office, Franklin County, O., and also including the streets and alleys recently vacated on which said lots bounded and abutted.

TERMS OF SALE, one-third upon confirmation of sale, one-third in three months and balance in six months from date of confirmation of sale, the deferred payments to bear interest at the rate of six per cent until paid and to be secured to the satisfaction of the receiver.

CHARLES P. OUTHWAITE, Receiver

COAL, COKE and STONE or BALLAST FORKS

SPECIAL HEAVY HOES and RAKES

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The cleanest and most thoroughly rebuilt.

All our own and in stock. Not scattered everywhere and merely listed.

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ENGINES—AUTOMATIC:—16 x 32 Buckeye, 15 x 14 Erie, 14¼ x 16 Buckeye, 14½ x 14 Ball & Wood, 13½ x 15 Taylor, 13 x 16 Erie, 12 x 14 Green, 12 x 12 N. Y. Safety, 10 x 10 Fisher, 9½ x 12 Leffel, 8 x 10 Allfree, etc.

ENGINES—THROTTLING:—18 x 24 Erie, 16 x 20 Chandler & Taylor, 16 x 18 Erie, 14 x 24 Atlas, 13 x 16 Chandler & Taylor, 14 x 14 Lewis, Vertical, 10 x 16 Owens, Lane & Dyer, 10 x 12 Industrial, 9 x 12 Ajax, 8 x 12 Climax, 7 x 12 H. S. & G., 6 x 8, Clark, etc.

BOILERS—STATIONARY:—72 x 18 High Pressure, 72 x 18 Standard, 72 x 16, 66 x 16, 60 x 20, 60 x 16, 54 x 16, 54 x 14, 54 x 12, 48 x 16, 48 x 14, 44 x 14, 40 x 12, 40 x 9, 36 x 16, 36 x 10, etc.

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(1) 26 in. x 10 ft. Lodge & Shipley, quick change gear
(1) 32 in. x 12 ft. Lodge & Shipley, quick change gear
(1) 32 in. x 12 ft. Walcott
(1) 34 in. x 8 ft. Flather
(1) 34 in. x 10 ft. Lodge & Barker
(1) 24 in. x 12 ft. Lodge & Shipley, quick change gear
(1) 24 in. x 16 ft. Lodge & Shipley, quick change gear
(1) 26 in. x 12 ft. Reed
(1) 27 in. x 10 ft. Lodge & Shipley, quick change gear
(1) 27 in. x 14 ft. Lodge & Shipley, quick change gear

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(1) 42 in. x 24 in. x 8 ft. Ingersoll, slab

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(1) 26 in. x 26 in. x 10 ft. Powell, 2 heads
(1) 36 in. x 36 in. x 10 ft. Gray, 2 heads
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PRESSES
(2) No. 20 Bliss
(1) Dag No. 4 Ferracute
(1) D7b Ferracute
(1) No. 42 Toledo
(1) No. 8 Greenerd arbor

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(1) 3 1-2 in. Burr
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1 Power House 40' x 70'.
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Any advertisement appearing in the liner columns of THE IRON TRADE REVIEW, will be given one insertion free of charge in PENTON'S LIST, and when such advertisement is one that would be of interest to the foundry trade, it will likewise be given one insertion free of charge in THE FOUNDRY.

POSITIONS VACANT.

EXPERIENCED MAN ON AUTOMOBILE cylinder molds and cores wanted, who has been foreman, assistant foreman or workman. Thorough knowledge required. State experience and qualifications. Address Box 465, THE IRON TRADE REVIEW, Cleveland, O. I.T.R.

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POSITIONS WANTED.

FOUNDRY SUPERINTENDENT, WHO has made good in present position, desires to make change, 18 years' experience as foreman and superintendent on engine, machine tool, electrical and jobbing work. Competent to take full charge of foundry in all its details, making estimates on work, machine molding, cupola practice and mixing irons from their analysis, core making, foundry costs, etc. Would like to correspond with party desiring services of first class man. Can furnish ample references as to character and ability. Address Box 469, THE IRON TRADE REVIEW, Cleveland, Ohio. I.T.R.

POSITION DESIRED AS SUPERINtendent or assistant superintendent of farm implement concern by practical, wide-awake married man 35 years of age—expert in designing and manufacturing farm implements—draftsman, patternmaker and foundryman—four years with the International Harvester Co., 15 years with other important farm implement concerns. References unquestionable. Address Box 85, PENTON'S LIST, Cleveland, Ohio. p.

POSITION WANTED BY FOREMAN PATternmaker, 20 years' experience on all classes of work, large work especially. Familiar with molding machines and metal patterns. Capable of taking charge of foundry; 8 years superintendent of pattern department and foundry. Steady, sober and reliable, practical mechanic in both trades. Best of references. Address Box 80, PENTON'S LIST, Clevland, O. p.

POSITION WANTED BY MACHINE patternmaker, age 36, married, sober and steady; 15 years' experience, past three years assistant foreman in large plant in Philadelphia. Competent in handling men and drafting—willing to work. A-1 references as to character and ability. Eastern Pennsylvania preferred. Address Box 83, PENTON'S LIST, Cleveland, O. p.

POSITION WANTED AS SUPERINTENDent or master mechanic by young man 34 years old. Mechanical experience on rolling mill and furnace work, electric cranes, ore handling machinery, locomotive and stationary engines, government work, etc. Executive ability, character and integrity the best. Will be open for engagement by June 1, 1909. Address Box 91, PENTON'S LIST, Cleveland, O. p

BY STRICTLY TEMPERATE MIDDLEaged molder, as foundry foreman; 21 years' experience in most up-to-date foundries; understand mixing of iron, cupola practice, estimating, drawings, operation of all kinds of molding machines; all most useful rigger, and competent to install and keep a cost and time system. Address Box 467, THE IRON TRADE REVIEW, Cleveland, O. I.T.R.

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POSITION WANTED AS SUPERINTENDent or foreman by a thoroughly competent and experienced foundryman, on machinery or jobbing work. Competent to take entire charge of foundry and handling of men. Sober and a hustler. Best of references. Address Box 87, PENTON'S LIST, Cleveland, Ohio. p.

WANTED BY AN UP-TO-DATE ENERgetic young foundryman, position as superintendent or foreman of plant, where a hustler is needed. Heavy machinery or engine work preferred. Can produce results with minimum cost. Good handler of men, expert on labor saving devices and mix by analysis. References. Address Box 82, PENTON'S LIST, Cleveland, O. p.

MACHINE SHOP MANAGER OPEN FOR position. Familiar with all kinds of heavy machinery, engines, structural and foundry work. Can get better results than you now secure. Either straight salary or commission based on savings. Address Box 470, THE IRON TRADE REVIEW, Cleveland, O. I.T.R.

POSITION DESIRED AS SECRETARY, sales manager or district office manager. Either commission or salary. Long experience, large acquaintance with best trade in country; posted on all modern office methods, also shop experience. Address Box 471, THE IRON TRADE REVIEW, Cleveland, O. I.T.R.

PROGRESSIVE YOUNG MAN IS OPEN to engagement, as foundry foreman. Can handle foundry from pig iron and scrap market to finishing high-grade light to medium-weight gray iron castings; can design, build and operate any equipment needed in modern foundry; can handle men and get results. Only first-class firm wanting first-class man need reply. A-1 references will be gladly furnished. West Central States preferred. Address F. W. J., 305 Western avenue, Janesville, Wis. I.T.R.

AS BLAST FURNACE MANAGER OR superintendent. Eighteen years' constructive, operative, executive practical Northern and Southern experience; will get best general cost results from plant; graduate chemical engineer; A-1 references. Address Box 466, THE IRON TRADE REVIEW, Cleveland, O. I.T.R.

POSITION WANTED BY FIRST-CLASS foundry foreman, held present position for 10 years, would like a change; 20 years' experience as foreman on all classes of light and heavy engine work, and mining machinery of all kinds. Good mixer and melter of both iron and brass. Will take charge of pattern shop in connection with foundry if so desired. Best of references as to ability; an up-to-date hustler, sober and reliable; can produce results; shop in middle west or coast preferred. Address Box 61, PENTON'S LIST, Cleveland, Ohio. p.

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EXCELLENT WATER POWER AND FACtory site for rent or sale. Good town of 1500. Cheap help plentiful. Address Merritt Mfg. Co., Constantine, Mich. p.

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WANTED, MISCELLANEOUS.

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The Iron Trade Review

Cleveland.

NATIONAL TUBE COMPANY, Pittsburgh, Pa., have recently published a catalog of their line of Drive Well Points and Well Supplies. The illustration of this new book, which will appear in next week's issue, and accompanying summary of contents should receive the attention of all who are interested in this class of material.

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¶ At the Convention it looked as if even such a short time as a minute could have hatched out a half dozen molding machines, three or four patent fluxes, and then some other new things to spare.

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